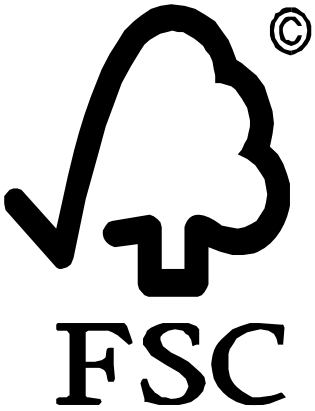

ECONOMIC ANALYSIS OF COMMUNITY FOREST PROJECTS IN CAMEROON

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Submitted to Georg-August University of Goettingen, Faculty of Forest Science and Wood Ecology for partial requirement of the award of Masters of Science (M.Sc.) in Tropical and International Forestry.

November 2007

Goettingen, Germany

“To my Heavenly Father who always makes a way where there seems to be no way;

And to my beloved family, my wife Carine and my daughter Ketsia Samuelle”

Acknowledgments

I wish to express my sincere gratitude to all individuals and institutions that in one way or another contributed to the successful completion of this work. First, I wish to express my heartfelt gratitude to my academic Supervisors, P.D. Dr. Olschewski Roland, lecturer in faculty of forestry in the Georg-August University of Goettingen and Dr. Guillaume Lescuyer, researcher in CIRAD-CIFOR, who have patiently guided me in all phases of this study. Their encouragements, constructive criticisms and patience are highly appreciated.

I am greatly thankful to the financial support offered to me by the *Deustcher Akademischer Austausch Dienst* (DAAD) for awarding me a Fellowship to cover my MSc. study costs. I am also greatly indebted to the Center for International Forestry Research (CIFOR) and the Forest Stewardship Council (FSC) which through a financing of Global and Environmental Facility (GEF) "Improved certification schemes for sustainable tropical forest management" provided the funding and facilities that enabled the field research in Cameroon. Importantly to state, the views and interpretation reflected in this document are those of the author and do not necessarily reflect an expression of opinion on the part of these institutions.

I greatly acknowledge the tireless assistance of Dr. Mbolo Marie and Mr Mimbimi Parfait of the FSC Cameroon each of the time I had to be introduced to the different study sites. I extend my thanks to the many people at CIFOR who hosted my research in Cameroon. Special thanks to Abdon Awono, Phil Rene Oyono, Dr. Ousseynou Ndoye, Dr. Chimère Diaw of CIFOR for sharing relevant information during this research.

I express my great thanks to the COPAL and Bimbia Bonadikombo communities, without their cooperation this study would have not seen the day of light. Special thanks to Abe Pierre agent of development in COPAL, Hon Mrs Gwendolyne Burnley president of the BBNRMC, Janvier Mondoa, forest manager in the Bimbia Bonadikombo community forest and Gerome Keji, their assistance has been instrumental to the success of the field study.

Thank you to my student colleagues who have shared courses with me and with whom we have had good times during this programme.

I owe so much to my family and friends for the moral and material support and vital energy they provided during this research. Hearty thanks to my Brethrens in Christ in Goettingen whose spiritual support has always come in a timely fashion. Many thanks to my beloved wife Carine and my daughter Ketsia for their permanent support, love and patience, which have been priceless during the hardest time of this research.

Let me apologize for those whose names I have inevitably not been able to mention. I greatly appreciate their contribution to the heightening of this work. *Thank you! Merci! Danke schön!*

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BB	*Bimbia Bonadikombo*
BBNRMC	*Bimbia Bonadikombo Natural Resource Management Council*
BCR	*Benefit-Cost Ratio*
Cat.	*Category*
CBA	*Cost-Benefit Analysis*
cf.	*confer*
CIG	*Common Initiative Group*
CF	*Community Forest*
CIFOR	*Centre for International Forestry and Research*
COPAL	*Coopérative des Paysans et Agriculteurs de la Lékié*
DBH	*Diameter at Breast Height*
et al	*et alii*
1st	*First*
FSC	*Forest Stewardship Council*
ha	*hectare*
HCVZ	*High Conservation Value Zone*
HW	*Hardwood*
IRR	*Internal Rate of Return*
Kg	*Kilogramme*
LBG	*Limbe Botanic Garden*
MCP	*Mount Cameroon Project*
MDE	*Minimum Diameter of Exploitation*
#	*Number*
NGO	*Non Governmental Organization*
NPV	*Net Present Value*
NTFP	*Non Timber Forest Product*
p.a.	*Per annum*
Pers. comm.	*Personal communication*
2^{nd}	*Second*
SMP	*Simple Management Plan*
SNV	*Dutch Development Organization*
SRTP	*Social Rate of Time Preference*
SW	*Softwood*
w.t.p.	*Willingness to pay*

Abstract

In this paper, two community forest projects namely, COPAL and Bimbia Bonadikombo in Cameroon, are analysed by applying a financial and economic cost-benefit framework. Therefore, three scenarios namely, the 'strict implementation of the simple management plan' (scenario1), the 'without community forest' (scenario 2), and the 'adjusted implementation of the simple management plan' (scenario 3) are compared. The net present value criterion is used to this end. Direct use values such as timber, charcoal, firewood, as well as indirect-use values such as carbon sequestration or fishing-ground protection are valued based on market prices, shadow prices and cost-based techniques. Household surveys have been used for some activities of the management plan such as farming and non-timber forest product collection.

The results show that in the COPAL community forest, the net returns per ha from the simple management-based scenarios are positive and superior to that of the scenario 2, with the scenario 1 being the best option, from the economic perspective. Financially speaking the situation 'without community forest' stands as the best alternative. In Bimbia Bonadikombo community forest, while financial analysis reveals the scenario 2 to be the worthiest, on the other hand the economic analysis clearly shows the highest returns per ha from the 'adjusted implementation of the simple management plan' scenario. This value rests almost entirely on the environmental benefits of the forests such as fishing-ground protection and carbon sequestration, that accrue nationwide and to the global community. However, the legal entity in charge of the management of the community forest displays a negative net present value. The sensitivity analysis, with varied discount rates, confirms the economic value associated to the management of both community forests.

Finally, the findings of the study indicate that community forests deprived from abundant forest resources, with a conservation-oriented objective, will necessarily need an external support. Potential gainers may support such community initiatives through adequate and effective transfer mechanisms. Furthermore, it is important that local community engaged in the community forest project, get basic analytical skills to enable a sound decision-taking.

Key words: *Community forest; Scenario; 'Implementation of the simple management plan'; 'Without community forest'; 'Adjusted implementation of the simple management plan'; Financial analysis; Economic analysis; COPAL; Bimbia Bonadikombo; Cameroon.*

Résumé

Dans ce rapport, deux projets de forêts communautaires, à savoir COPAL et Bimbia Bonadikombo au Cameroun, font l'objet d'une analyse économique et financière avantages-coûts. Trois scénarii dont, « la mise en œuvre stricte du plan simple de gestion » (scénario 1), « la situation sans forêt communautaire » (scénario 2) et « la mise en œuvre ajustée du plan simple de gestion » (scénario 3) sont comparés. Pour ce faire, la valeur actualisée nette est utilisée comme critère d'évaluation. Les valeurs directes à l'exemple du bois d'œuvre, du charbon ou du bois de feu, de même que des valeurs indirectes telles que la séquestration du carbone ou la protection des frayères sont évaluées en recourant aux prix de marchés, aux prix rectifiés, et aux coûts d'opportunité. Des enquêtes de ménages ont été réalisées pour l'évaluation des activités agricoles et la collecte des produits forestiers non ligneux.

Les résultats montrent qu'à la COPAL, du point de vue économique, les revenus nets par hectare résultant des scénarii de mise en œuvre du plan simple de gestion sont plus importants que ceux obtenus au scénario 2, le scénario 1 étant la meilleure option. Sur le plan financier, la situation 'sans forêt communautaire' se présente comme la meilleure alternative. Dans le même ordre d'idée, à Bimbia Bonadikombo, alors que l'analyse financière indique le scénario 2 comme étant l'option la plus profitable, l'analyse économique par contre considère « la mise en œuvre ajustée du plan simple de gestion » comme la meilleure alternative. Cette valeur résulte des services environnementaux - telles que la séquestration du carbone et la protection des frayères - qui procurent un bien-être aussi bien à l'échelle nationale, que mondiale. Toutefois, l'entité de gestion enregistre un revenu net à l'hectare négatif. L'analyse de sensibilité effectuée sur la base de divers taux d'actualisation confirme la valeur économique associée à la gestion des deux forêts communautaires.

En définitive, il apparaît que les forêts communautaires assises sur des massifs forestiers appauvris en essences de valeur, aient besoin d'une aide financière extérieure pour satisfaire leurs objectifs de conservation. Les potentiels bénéficiaires de ce type de gestion peuvent alors soutenir les communautés locales au travers de mécanismes effectifs de transfert. En outre, il apparaît approprié que les capacités des communautés soient renforcées dans le domaine de l'analyse économique de base, afin de rendre possible des processus locaux de prise de décision viables.

***Mot clés** : Forêt communautaire ; Scénario ; Mise en œuvre du plan simple de gestion ; Situation sans forêt communautaire; Mise en œuvre ajustée du plan simple de gestion ; Analyse financière ; Analyse économique ; COPAL ; Bimbia Bonadikombo ; Cameroun.*

Executive summary

Community forestry has been a source of high expectations for various stakeholders and especially for the local communities, since the inception of the first community forests (CF) about ten years ago. Today, the still-sustained infatuation of local populations towards acquisition of a community forest is largely motivated by the entertained hopes to derive substantial benefits from their exploitation. However, as a rule in Cameroon, it has been observed that very often communities start the exploitation of the forest with little visibility on the prospective benefits they will get and even worse if they can cover the collective investment mentioned in the simple management plan (SMP). This lack of prior economic analysis increases the likelihood of social tensions within the community in the case returns on investment are not as high as expected or do not occur at all. Therefore, applying a financial and economic cost-benefit analysis to community forest project has been seen as a way to address this issue.
The objectives of the study were to (i) estimate the financial and economic benefits and costs of the community forest SMP and of the 'without community forest' situation; (ii) develop alternative management scenario(s) for the community forest with the participation of the local stakeholders (iii) proceed with a sensitivity analysis of the SMP; (iv) determine the potential distribution of costs and benefits among key stakeholders for all the scenarios; and (v) determine the most efficient scenario for the community forest.

Two community forests have been selected namely the "*Coopérative des Paysans et Agriculteurs de la Lékié"* (COPAL) and the Bimbia Bonadikombo (BB) in the Centre and the South-West provinces of Cameroon respectively. The COPAL CF has not yet started its exploitation, while the BB CF is presently at the revision phase of the SMP. In each of these community forests, costs and benefits of activities featured in the SMPs have been assessed following three management options (scenarios). The different management options include: (i) the scenario 1: 'strict implementation of the SMP'; (ii) the scenario 2: 'without community forest'; (iii) the scenario 3: 'adjusted implementation of the SMP'. Only activities of the SMP likely to vary across the different scenarios along with their indirect benefits have been considered. In the COPAL SMP, these activities include: timber exploitation; non-timber forest product collection; farming; and the carbon storage as environmental benefit. In the BB CF apart from timber exploitation, other activities include: charcoal and firewood production; farming; ecotourism; along with carbon storage, and fishing-ground protection as environmental benefits. Costs incurred by the legal entity consequently to the management of the BB CF have also been taken into consideration.

The estimates were derived from both primary (surveys) and secondary data (various reports including the CF SMPs) and follow the principle of a conventional cost-benefit analysis. This exercise was made using the net present value (NPV) calculations for the different scenarios covering the assumed 25-year period of the management agreement validity. Market prices, shadow prices and cost-based techniques were used for the valuation of direct and indirect forest uses. The financial and economic analysis used a discount rate of 5%. Sensitivity analysis was also carried out for a number of hypotheses at various discount rates.

The results of the analysis are quite similar for both community forests, suggesting that the implementation of the SMP- based scenarios are economically a viable option in comparison of the 'without community forest' scenario.

In the COPAL CF: The Net Present Value (NPV) estimates from the implementation of the SMP (scenario 1 and 3) are positive and superior to that of the scenario 2, with the 'strict implementation of the SMP' showing the highest returns per ha (~ 554,000 CFAF/ha) from the economic perspective. On the other hand, the 'without CF' situation is financially the best management option as related to the other alternatives (~ 98,000 CFAF/ha). The table below shows a summary of the financial and economic values across the different scenarios in the COPAL CF.

Summary Management Option Financial and Economic Values in the COPAL CF

Forest uses	***Scenario 1: Strict implementation of the SMP*** **(CFAF/ha)**		***Scenario 2: No community forest*** **(CFAF/ha)**		***Scenario 3: Adjusted implementation of the SMP*** **(CFAF/ha)**	
	Financial	*Economic*	*Financial*	*Economic*	*Financial*	*Economic*
Timber exploitation	11,987	17,490	18,703	25,123	7,242	12,055
NTFP collection	41,610	48,605	30,246	38,009	38,516	82,792
Food crop farming	33,806	641,816	48,964	584,257	31,009	608,668
Carbon storage	-	-153,965	-	-315,707	-	-184,759
Total	***87,403***	***553,946***	***97,913***	***331,683***	***76,767***	***518,756***

Importantly, the distribution of the net returns per ha over the 25-year project cycle in the COPAL CF clearly indicates that the net incomes from the situation 'without CF' are quite high for almost the entire project life. However, if utilization of the forest is to be pursued for a new cycle, an anticipated decrease of returns is predictable as a consequence of the dramatic diminishing of the resource stock. This being particularly critical for the case of timber exploitation, where the annual returns decrease gradually at the end of the cycle. Therefore, if generating sustainable income is to be achieved, the management of the forested area under the legal status of a community forest is advisable.

The sensitivity analysis confirms the economic efficiency of the 'strict implementation of the SMP' option in the COPAL CF. For instance, where timber exploitation is concerned, the results of the sensitivity analysis per activity show that, even if expected timber costs increase by 10% at a discount rate of 3% the NPV is still the highest compared to the situation 'without CF'. Keeping the same hypothesis of cost decrease, at 8% discount rate, the 'strict implementation of the SMP' displays the best NPV (~ 9,000 CFAF/ha) compared to the 'adjusted implementation of the SMP' (~ 7,200 CFAF/ha). The results of the overall sensitivity analysis (that is for the different forest uses) with varied discount rates (3%, 8%, 12%, 35%) are in line with the preceding finding. Indeed, up to a discount rate of 8% the 'strict implementation of the SMP' option displays the best net returns per ha (~ 400,000 CFAF/ha) economically speaking.

Likewise, in the BB CF: the SMP-based management options displayed the best returns per ha in economic terms; with the 'adjusted implementation of the SMP' displaying the highest NPV (~ 2,400,000 CFAF/ha) compared to the 'strict implementation of the SMP' (~ 2,342,000 CFAF/ha) purposefully oriented towards conservation. The net advantage of the

implementation of the SMP-based scenarios is related to the many environmental services offered by the forest. This being particularly relevant for the scenario 1, where services such as fishing-ground protection or carbon storage contribute for about 40% of the total value of net returns per ha. Similarly with the case of the COPAL CF, the financial efficiency is realized by the 'without CF' scenario (~655,000 CFAF/ha). The management costs derived from the costs incurred by the legal entity in operating the CF less the benefits perceived from the various fines and selling of permits display negative NPVs of about -3,300 CFAF/ha and -1,700 CFAF/ha respectively for the scenario 1 and 3. The following table summarizes the results of the financial and economic analysis of the different scenarios over the 25-year time horizon.

Summary Management Option Financial and Economic Values in the BB CF

Forest uses	***Scenario 1: Strict implementation of the SMP*** **(CFAF/ha)**		***Scenario 2: No community forest*** **(CFAF/ha)**		***Scenario 3: Adjusted implementation of the SMP*** **(CFAF/ha)**	
	Financial	*Economic*	*Financial*	*Economic*	*Financial*	*Economic*
Timber exploitation	37,204	48,393	32,011	42,591	26,944	37,632
Charcoal burning	25,479	35,764	47,578	59,196	37,129	56,778
Firewood collection	5,464	10,408	12,143	19,728	15,126	22,477
Farming	466,554	1,346,311	562,980	1,499,623	431,185	1,490,839
Ecotourism	16,669	16,669	-	-	16,669	16,669
Carbon storage	-	324,000	-	190,560	-	303,660
Fishing-ground protection (200ha)	-	563,758	-	198,984	-	479,121
Management costs	-3,325	-3,325	-	-	-1,748	-1,748
Total	***548,045***	***2,341,978***	***654,712***	***2,010,682***	***525,305***	***2,405,429***

The annual distribution of the net returns over the project life cycle for each of the different activities suggests 'the adjusted implementation of the SMP' and the 'without community forest' scenarios to generate the best annual net incomes. The 'strict implementation of the SMP' towards highly-oriented conservation goal displays relatively low annual net returns, largely attributable to the reduction in the quantity of forest resources allowed to extraction each year. The scenario 1 is therefore the most likely to allow continued extraction of forest resources for the next cycles. However, if this management option, entailing restrictions of the extracted quantity of forest product, is to be implemented, livelihood alternatives should necessarily be developed.

The results of the sensitivity analysis indicate that: - the NPV is rather quite sensitive to the choice of the discount rate; - the economic calculations of the 'strict implementation of the SMP' display the best net returns par ha both financially (~ 681,000 CFAF/ha) and economically (2,800,000 CFAF/ha) at a low discount rate of 3%.

The implementation of a given management option entails various stakeholders to bear some costs, while accruing the resulting benefits. In the COPAL CF, the main stakeholders identified are: the legal entity (COPAL); the local community; the local operators; and the global community. The COPAL legal entity accrues a larger share of the net returns (~16,000

CFAF/ha) through the ‘strict implementation of the SMP’. It is assumed that the COPAL is the structure to run the small-scale forest enterprise. The management of the COPAL forest according to the strict terms of the SMP is the option that generates the best net returns to the local community as far as timber exploitation (~ 10,000 CFAF/ha) and NTFP collection (37,400 CFAF/ha) are concerned. The global community also benefits from ‘the strict implementation of the SMP’. Thus, the net incremental benefits calculated between the ‘strict implementation of the SMP’ and the ‘without CF’ scenario for carbon sequestration is about 162,000 CFAF/ha.

In the BB CF, the stakeholders identified included: the BB Natural Resource Management Council legal entity, the various user groups (timber exploiter, charcoal burner, firewood collector); the Cameroonian nation; and the global community. The ‘strict implementation of the SMP’ appears to be the management option benefiting the most to the Cameroonian nation (~576,000 CFAF/ha) and the global community as well (324,000 CFAF/ha), while causing the highest deficit to the legal entity (~ -3,300 CFAF/ha).

Therefore, for implementation of the SMP to be a financially and economically viable option, it is important that basic analytical economic skills be provided to the legal entity so that to allow sound decision taking; capacity building in the field of marketing and market information is also necessary. As a great share of environmental benefits accrues nationwide and to the global community, it seems necessary to support the communities embarked in conservation. For this reason, appropriate transfer mechanisms should be developed that might allow to counterbalance the opportunity cost of conservation borne by the community. This might be done through undertaking of alternative livelihood projects.

Résumé exécutif

Il y a environ dix ans avec le démarrage des premières forêts communautaires, la foresterie communautaire a suscité de vives attentes auprès de différentes parties prenantes, dont les communautés locales. Aujourd'hui, l'engouement soutenu des populations forestières en vue de l'acquisition de forêts communautaires est entretenu par l'espoir de réaliser des bénéfices substantiels à la suite de leur exploitation. Cependant au Cameroun, il a été observé qu'en règle générale les communautés s'engagent dans l'exploitation de leur forêt communautaire (FC) sans avoir une réelle visibilité des potentiels bénéfices, ou encore plus grave s'ils arriveront à couvrir les investissements collectifs mentionnés dans le plan simple de gestion (PSG). Cette absence d'analyse économique préalable accroît le risque des tensions sociales au sein du village au cas où le retour sur investissement est faible ou inexistant. L'une des possibilités de traiter ce problème a été d'effectuer une analyse financière et économique avantage coût de projet de FC. Les objectifs de l'étude étaient : (i) d'estimer les bénéfices financiers et économiques du PSG de la FC, ainsi que ceux de la situation 'sans FC' ; (ii) de développer des (un) scénario(s) de gestion alternatif(s) de la forêt avec la participation des parties prenantes locales ; (iii) de procéder à une analyse de sensibilité du PSG ; (iv) de déterminer la distribution des coûts et des bénéfices entre les principales prenantes pour chaque scénario ; (v) de déterminer le scénario le plus efficient pour la forêt communautaire.

Deux FCs ont été sélectionnées à savoir, la FC *"Coopérative des Paysans et Agriculteurs de la Lékié"* (COPAL) et la FC Bimbia Bonadikombo (BB) respectivement dans la province du Centre et du Sud-Ouest. L'exploitation de la FC de COPAL n'a pas encore démarré, tandis que la FC de BB est actuellement arrivé au stade de révision de son PSG. Dans chacune des FCs, les coûts et les bénéfices des activités comprises dans les PSGs ont été évalués suivant trois options de gestion (ou scénarios). Les différents options de gestion comprennent : (i) scénario 1 : 'la mise en œuvre stricte du PSG' (ii) scénario 2 : 'la situation sans FC' ; (iii) scénario 3 : 'la mise en œuvre ajustée du PSG'. Seules les activités du PSG susceptibles de varier en fonction des différents scénarios, accompagnées des bénéfices indirects susceptible de résulter d'un mode de gestion forestier donné ont été pris en considération. Dans la FC de COPAL, les usages de la forêt comprennent : l'exploitation du bois ; la collecte des produits forestiers non ligneux (pfnls) ; l'agriculture ; et comme bénéfice environnemental la séquestration du carbone. Pour ce qui est de la FC de BB, en dehors de l'exploitation du bois, les activités telles que la production du charbon et la récolte du bois de feu, l'agriculture et l'écotourisme ; de même que des bénéfices environnementaux telles que la séquestration du carbone et la protection des frayères ont été analysés. Les coûts contractés par l'entité juridique et inhérents à la gestion de la FC ont également été pris en compte.

Les estimations ont été obtenues à partir des données primaires (enquêtes structurées) et des données secondaires (divers rapports incluant les PSGs des FCs) et suivent les principes d'une analyse avantage coût usuelle. L'analyse a été effectuée sur une période de 25 ans, en recourant aux calculs de la valeur actualisée nette (VAN) pour les différents scénarios. L'estimation des valeurs directes et indirectes de la forêt s'est appuyée sur les prix de marché, les prix rectifiés et les coûts d'opportunité. Un taux d'actualisation de 5% a été utilisé dans le cadre de l'analyse financière et économique. Par la suite, une analyse de sensibilité a été exécutée suivant un certain nombre d'hypothèses et l'application de divers taux d'actualisation.

Les résultats de l'analyse sont relativement similaires pour les deux FCs, suggérant que les scénarios de mise en œuvre du PSG sont une option économiquement viable en comparaison du scénario 'sans FC'.

Dans la FC de COPAL : Sur le plan économique, les estimations de la VAN des scénarios de mise en œuvre du PSG (scénario 1 et scénario 3) sont positives et supérieures à celles de la 'situation sans FC'; avec la 'mise en œuvre stricte du PSG' affichant les revenus à l'ha les plus importants (~ 554,000 FCFA/ha). Cependant, la situation 'sans FC' est sur le plan financier l'option de gestion la plus rentable (~ 98,000 FCFA/ha) comparativement aux autres alternatives. Le tableau ci-dessous présente un résumé des valeurs économiques et financières suivant les différents scénarios dans la FC COPAL.

Synthèse des valeurs économiques et financières des options de gestion dans la FC de COPAL

Usages de la forêt	***Scénario 1: Mise en oeuvre stricte du PSG*** **(FCFA/ha)**		***Scénario 2: sans FC*** **(FCFA/ha)**		***Scénario 3: Mise en oeuvre ajustée du PSG*** **(FCFA/ha)**	
	Financier	*Economique*	*Financier*	*Economique*	*Financier*	*Economique*
Exploitation du bois	11,987	17,490	18,703	25,123	7,242	12,055
Collecte des pfnls	41,610	48,605	30,246	38,009	38,516	82,792
Agriculture vivrière	33,806	641,816	48,964	584,257	31,009	608,668
Séquestration du carbone	-	-153,965	-	-315,707	-	-184,759
Total	***87,403***	***553,946***	***97,913***	***331,683***	***76,767***	***518,756***

La distribution des revenus nets à l'ha durant la vie du projet de 25 ans présente clairement la 'situation sans FC' comme celle générant les revenus annuels les plus importants sur la quasi-totalité du projet. Cependant, si l'exploitation de la forêt est préconisée pour un autre cycle, une baisse des revenus peut-être anticipée comme conséquence de la réduction du stock de produits forestiers. Ceci étant particulièrement avéré dans le cadre de l'exploitation du bois dont les revenus annuels chutent graduellement en fin de cycle. En définitive, si l'objectif à terme est la génération des revenus durables, la gestion de l'espace forestier sous le statut légal de la FC est une option recommandable.

L'analyse de sensibilité confirme l'efficacité économique de la 'mise en œuvre stricte du PSG' dans la FC de COPAL. Ainsi, les résultats de l'analyse de sensibilité par activité pour l'exploitation du bois, révèle que pour un taux d'actualisation de 3%, même si les coûts viennent à diminuer de 10%, la 'mise en œuvre stricte du PSG' présente la meilleure VAN. En conservant la même hypothèse de baisse des coûts, pour un taux d'actualisation de 8%, la 'mise en œuvre stricte du PSG' présente la VAN la plus élevée (~ 9,000 FCFA/ha) comparativement à la 'mise en œuvre ajustée du PSG' (~ 7,200 FCFA/ha). Les résultats de l'analyse de sensibilité générale (i.e. tous usages forestiers compris) suivant divers taux d'actualisation (3%, 8%, 12%, 35%) sont en conformité avec le résultat précédent. En effet, sur le plan économique, avec un taux d'actualisation de l'ordre de 8%, la gestion de l'espace

forestier de la COPAL suivant les termes stricts du PSG présente les meilleurs revenus nets à l'ha (~ 400, 000 FCFA/ha).

De la même manière dans la FC de BB, les scénarios de mise en œuvre du PSG présentent les meilleurs revenus à l'ha sur le plan économique ; avec 'la mise en œuvre ajustée du PSG' affichant la VAN (~ 2,400,000 FCFA/ha) la plus élevée comparativement à la 'mise en œuvre stricte du PSG' (~ 2,342,000 FCFA/ha) prioritairement orientée vers la conservation de la forêt. L'avantage net des scénarios de mise en œuvre du PSG est grandement lié aux services environnementaux de la forêt. Ceci est particulièrement pertinent pour le scénario 1, où les services telles que la protection des frayères et la séquestration du carbone contribuent à près de 40% de la valeur totale des revenus nets à l'hectare. La 'situation sans FC' est sur le plan financier la plus viable (~ 655,000 FCFA/ha). Les coûts de gestion de la FC - résultant des coûts de fonctionnement de la FC supportés par l'entité légale soustraits des bénéfices générés par le payement de diverses amendes et la vente des permis d'exploitation – affiche une VAN négative d'environ -3,300 FCFA/ha et - 1,700 FCFA/ha respectivement pour les scénarios 1 et 3. Le tableau suivant résume les résultats de l'analyse financière et économique suivant les différents scénarios sur la durée d'analyse de 25 ans.

Synthèse des valeurs économiques et financières des options de gestion dans la FC de BB

Usages de la forêt	***Scénario 1: Mise en oeuvre stricte du PSG*** **(FCFA/ha)**		***Scénario 2: Sans forêt communautaire*** **(FCFA/ha)**		***Scénario 3: Mise en oeuvre ajustée du PSGP*** **(FCFA/ha)**	
	Financier	*Economique*	*Financier*	*Economique*	*Financier*	*Economique*
Exploitation du bois	37,204	48,393	32,011	42,591	26,944	37,632
Charbon	25,479	35,764	47,578	59,196	37,129	56,778
Collecte du bois	5,464	10,408	12,143	19,728	15,126	22,477
Agriculture	466,554	1,346,311	562,980	1,499,623	431,185	1,490,839
Ecotourisme	16,669	16,669	-	-	16,669	16,669
Sequestration du carbone	-	324,000	-	190,560	-	303,660
Protection des frayères (200ha)	-	563,758	-	198,984	-	479,121
Coûts de gestion	-3,325	-3,325	-	-	-1,748	-1,748
Total	***548,045***	***2,341,978***	***654,712***	***2,010,682***	***525,305***	***2,405,429***

La distribution annuelle des revenus nets sur la durée de vie du projet de FC concernant les divers usages de la forêt, suggère que les scénarios de 'mise en œuvre ajustée du PSG' et 'sans FC' génèrent les revenus annuels les plus importants. La 'mise en œuvre stricte du PSG' en vue de la conservation de la FC présente des revenus nets annuels relativement faibles, largement imputables à la décision de réduire les taux d'extraction annuels de la ressource. Ce scénario est donc le plus susceptible de favoriser une extraction continue de la ressource sur les prochains cycles. Toutefois, si cette option de gestion de la forêt basée sur la restriction des quantités exploitables est mise en œuvre, alors un développement d'alternatives de subsistance est nécessaire.

Les résultats de l'analyse de sensibilité indiquent que : - la VAN est relativement sensible aux

choix du taux d'actualisation. Les calculs économiques de 'la mise en œuvre stricte du PSG' pour un taux d'actualisation bas de 3% présentent les meilleurs revenus nets à l'ha aussi bien sur le plan financier (~ 681,000 FCFA/ha), qu'économique (~ 2,800,000 FCFA/ha).

La mise en œuvre d'une option de gestion donnée de l'espace forestier suppose l'implication de diverses parties prenantes supportant les coûts et accumulant les bénéfices occasionnés. Dans le FC de la COPAL, les principales parties prenantes comprennent : l'entité juridique COPAL ; la communauté locale ; les opérateurs locaux et la communauté globale. La COPAL perçoit une part considérable des revenus (~16,000 FCFA/ha) au travers de la 'mise en œuvre stricte du PSG'. L'analyse considère dans ce cas que la COPAL se charge elle-même de la conduite de la petite entreprise de FC. En outre ce scénario est celui qui profite le plus aux communautés locales aussi longtemps que l'exploitation du bois (10,000 FCFA/ha) et la collecte des PFNLs (~37,400 FCFA/ha) est prise en compte. La communauté globale tire également profit de la 'mise en œuvre stricte du PSG'. En effet, les bénéfices nets incrémentaux calculés entre le scénario 1 et le scénario 2 pour la séquestration du carbone sont d'environ 162,000 FCFA/ha.

Dans la FC de BB, les parties prenantes identifiées comprennent : l'entité juridique le conseil de gestion des ressources naturelles de BB ; les divers utilisateurs de la ressource (exploitant de bois locaux, producteurs de charbon, collecteur de bois de feu) ; la nation du Cameroun ; et la communauté globale. La 'mise en œuvre stricte du PSG' apparaît comme l'option de gestion profitant le plus à la nation camerounaise (576,000 FCFA/ha) et la communauté globale (~ 324,000 FCFA/ha). Alors qu'elle cause le déficit le plus important à l'entité juridique (~ -3,300 FCFA/ha).

Ainsi, pour que la mise en œuvre du PSG soit une option économiquement et financièrement viables, il est nécessaire que soit effectué un renforcement de capacités des entités juridiques au travers d'une dotation de connaissances de base d'analyse économique pour rendre la prise de décision locale plus efficace ; de même qu'une formation dans le domaine du marketing et de l'information de marché. Etant donné qu'une part considérable des bénéfices environnementaux est capturée à l'échelle nationale et du monde, il semble opportun de soutenir les communautés engagées dans la conservation. De ce fait, des mécanismes de transfert adaptés doivent être développés, afin de faire contrepoids au coût d'opportunité de la conservation supporté principalement par les populations locales. De manière concrète, ce transfert peut se faire par la mise en œuvre de projets de développement locaux.

1. Introduction

In recent decades, community-based forest management has been a popular strategy in programs aimed at helping local populations conserve forests and improve their livelihoods (Bray et al, 2005; Brown, 1999). Many governments in developing countries claim to be decentralising natural resource to local actors (Larson, 2004). This current worldwide trend towards devolution of forestlands to local communities (White and Martin, 2002) has highlighted the potential significance of community forest enterprises. Many development actors have thought of community involvement in the management of forest for timber production as a way to reduce poverty, promote economic development and provide incentive for forest preservation (Wunder, 2001).

The Cameroonian State has not been isolated of this worldwide trend. One of the ground-breaking features of the 1994 forestry Law is to offer local community the responsibility to manage the forest resource. The concept of community forestry that was introduced accordingly, devolve management rights to local communities over certain categories of forest State lands, the so-called community forests (CF). Alike with other countries, in Cameroon, the explicit aim of community forestry was to involve rural communities in the sustainable management of their own forest, while providing them with income-generating mechanisms for equitable and socio-economic local development.

Though the process began quite slowly due to, mainly but not only, some administrative/technical hurdles, community forestry has become popular. Over the past few years, the number of community forest applications has significantly increased reflecting high expectations – very often financially driven[1]. In order to enhance the community ownership on the community forestry process, the forest administration has taken several steps aiming to facilitate emergence of real community forest-operated enterprises.

In some instances exploitation of community forests has shown a great potential to generate some benefits to the villagers (Fomete *et al*, 2001; Klein *et al*, 2001), however few examples exist of successful, long-term, sustainable forest enterprises involving communities (Shoana and Kainer, 2006). This is due mainly to impediments rising throughout the whole process of

[1] The statistics of the service in charge of community forestry in the forest ministry show a rising trend of the number of applications. In June 2002, 142 applications were registered against 378 in November 2006.

CF acquisition and its implementation. These often include *inter alia* : financial, technical, and institutional constraints during the simple management plan preparation stage on one side; and on the other, the lack of financial and technological capacity of local community to implement the simple management plan (SMP), abuses of contracting economic operators, low access to finances, unfair competition of sawn-wood from informal source within the domestic market, amateurism of community producers, weakness and low transparency of benefit sharing mechanisms (MINEF-DFID, 2004; CARFAD, 2006).

A conflicting environment among community members often results from exploitation of the CF, consequently to the disillusionment to gain larger share of benefits compared to all other forms of forest uses. It is worth to note that, the scarcity of economic data stands as a common denominator of community forest enterprises in Cameroon.

As a rule, local populations start exploitation of their forest with little visibility on the prospective benefits they will get, and even worse if they could cover the collective investments mentioned in the SMP. This lack of prior economic analysis increases the likelihood of social tensions within the community in the case returns on investment are not as high as expected or do not occur at all.

There is a wealth of research, studies, reports and documentation on community-based forest management in different parts of the world (Scherr *et al*, 2002; Castrén 2005). However, there is only limited factual systematic information available on costs and benefits of community forestry enterprises, this being particularly true for the case of Cameroon (Vabi *et al*, 2002). Thus, detailed analyses are needed. The potential for greater investment in, and returns from, community forest enterprises is great (Mayers, 2006). As they constitute an important opportunity to improve livelihoods in Cameroon, it becomes necessary to assess the economic viability of such projects.

Therefore, the main objective of this study is to run an economic and financial analysis in two community forests with a view to test their profitability. The basic assumption is that: implementation of SMP for timber production is not always a profitable and sustainable business for the rural community.

Specifically, the study intends to:

1 Estimate the financial and economic benefits and costs of the community forest SMPs and of the business-as-usual scenario (nothing happens);
2 Develop alternative scenarios for the community forests with the participation of the local stakeholders and estimate their financial and economic benefits and costs;
3 Proceed with a sensitivity analysis of the SMP;
4 Determine the potential distribution of costs and benefits among key stakeholders of the community forests for all scenarios;
5 Determine the most efficient scenario for the community forest.

The potential of community forestry to contribute to Cameroonian poor rural livelihood while fostering sustainable management cannot be understated. This is particularly relevant in a context where until recently, local populations have been excluded from the management of their forests and neglected in the benefit sharing process. The current situation is therefore source of great expectations from many stakeholders, among which forest populations are especially concerned. The finding of this study will contribute to fill the existing gap of empirical studies that focus on the cost and benefits of community forestry (cf. Vabi *et al,* 2002; Fomete *et al,* 2001; Klein *et al,* 2001). The information is particularly expected to assist the interested parties (mainly local population) to make informed decisions about the management of their forest. The experience can be extended to similar situations where communities are faced with the obligation to take sound decisions.

The report is organized in eight sections. Following the introduction, some features related to the context of community forestry in Cameroon are provided. The third section is devoted to the presentation of the study areas. The fourth section is subdivided into two parts, namely the theoretical framework and the methods. In the first part, the main steps for conducting an economic analysis are described, while the second part translates the theoretical part into practice. The fifth and the sixth section are concerned with the costs and benefits of different activities in each of the study sites. The scenarios of analysis are presented in this section. The seventh section presents the results of the cost-benefit analysis. The report ends with a conclusion that summarizes the main results of the analysis along with some recommendations.

2. Context of community forest in Cameroon

2.1. Evolution of the legal and regulatory framework of community forest

The striking feature of the 1994 Forest Act has been to make a room for involvement of local population in the management of their forest and forest-based resources. The materialization of this political will towards promoting community-based management is enshrined in the current forest legislation through community forests.

According to the forestry law (art.37) and the manual of procedure (MINEF, 1998), a community forest is defined as "*a part of the non-permanent forest estate, measuring up to 5000 ha, that is object of an agreement between government and a community in which communities undertake sustainable forest management for a period of 25 years renewable*"

Prior to the signature of the management agreement between the Government and the local community, some requirements must be fulfilled by the applicant:

- The community has constituted a legal entity and appointed a community forest manager who shall represent them in negotiations with government in matters of community forestry;
- The community has delineated and mapped the intended community forest area;
- The community has completed an 8-10% inventory of the timber, non-timber forest products (NTFPs), and wildlife of the forest;
- The community presents a simple management plan for the intended forest;
- The community shows proof of stakeholder agreement on the intentions of forest management.

In practice, most of the forest inventories carried out in view of the allocation of the CF, use sampling intensity ranging between 2% and 4% (MINEF-DFID, 2004).

Once the management agreement has been signed, implementation of the community forest is subject to some additional requirements namely:

- 100% forest inventory to be carried out on the annual plot of exploitation each year;
- the submission of annual activity plans to the forest service for approval;
- the placing of the annual activity report of the CF at the disposal of the Government;
- the review process of the SMP every five years.

According to the provisions of the forest law, the local population is henceforth expected to play a leading role in the management of their forest.

Local communities have very often perceived community forest as a way of securing access to the resource and as a means of collecting forestry revenues. In reality, though management rights are granted to the population, the Government still retains control over the land. The effectiveness of this devolution of power towards real empowerment of locals has often been questioned (Oyono *et al*, 2007). It is rather assessed as a conditional transfer of powers that makes the local managers accountable to the regional officers of the forest administration and thus leaves a small room for manoeuvre to local decision-taking.

More than a decade after the introduction of the concept of community forestry through the 1994 forest law and the publication of a Manual of Procedures for the Attribution, and Norms for the Management of Community Forests in 1998, the process has evolved through a difficult path of maturation.

Today, the process has become increasingly popular as a result of the combined efforts of development partners and a plethora of non-governmental organisations (NGOs) at the national and local level. Illustrative of this fact, is the constant increase of the average area dedicated to community forests that has increased steadily from 3000 ha in 1997 to 4560 ha in 2002 (Ezzine *et al*, 2005).

As earlier mentioned, the process of community forestry via the setting up of community forests has had since the very beginning to face various pitfalls from which administrative, financial and organizational hurdles were certainly the more acute (Lescuyer, 2007). In order to facilitate procedures and norms relevant to the process and to foster its ownership by local population, a number of steps have been taken including *inter alia*:

- The promulgation in 2001 of a pre-emption right decree, which allows communities to pre-empt the allocation of logging permits in nearby forests by indicating their intention to establish a CF;
- The ministerial circular in 2001 suspending contracts between industrial loggers and local communities in order to promote artisanal exploitation of CF;

- The ministerial decision in 2002 allowing communities to exploit their forest themselves without need to involve licensed operators the so-called "*exploitation en régie"*;

- The on-going review of the 1998 Manual of Procedures in a more participatory way.

Paradoxically, some recent developments in the context of CF regulations seem to preclude the explicit goal of letting community ownership grow over the community forestry process. That is the case of a decree enacted in February 2005 that obligates communities – in addition of the required SMP - to carry out an environmental impact assessment. Most actors have perceived this measure as being inopportune regarding the current state of community forestry in Cameroon and the consecutive additional costs incurred to the local communities. Another text likely to constrain efficiency of small-scale logging community enterprises is the circular letter of March 2006, according to which timber products from CFs are forbidden of exportation. These developments that complicate a little bit more the process of acquiring and managing a CF are likely to sustain the viewpoint of Sieböck (2002 p.36) according to which "*authorities are largely opposed to community forest management, and many administrative hurdles have been created*".

2.2. Community forestry: a potential tool to fight against rural poverty

The underlying article of faith of community forestry is that human well-being will be enhanced (Gilmour *et al,* 2004). Backing-up this viewpoint, Sunderlin (2006) underlines the importance for any community forestry initiatives from its outset to have poverty alleviation as the guiding motivation. Accordingly, the stated goal of community forestry in Cameroon, apart from transferring management rights to the forest population, has been poverty alleviation.

Most of the community forests have therefore focused on the logging to make worth of their forest.

Though implementation of the SMP oriented towards harvesting of timber has rather caused several conflicts of distributional nature at the village level, there is little doubt about its potential to generate substantial revenues to the local communities.

Cuny *et al,* (2006), report the experience of the Kongo CF in the eastern Cameroon. In five years of implementation of the SMP, the village and its inhabitants have received a lump sum of about 87,000$ (~43,500,000 CFAF), that has contributed to the socio-economic development of the village (with improvement of the habitat) while generating direct income

to many families (in form of employment). These achievements have been obtained in spite of frequent fund misappropriations by the members of the legal entity, and the non-respect of the terms of contract by some economic operators.

Fomete *et al* (2001) have assessed the potential of CF timber exploitation based on a review of some CF experiences. For a given community, exploitation of a high valuable timber (Iroko) using a portable sawmill of the type Lucas Mill, provided the village with about 32,000 CFAF/m3. Even exploitation of softwood timber (Ayous) using an engine chainsaw displayed positive results, with a contribution of about 19,000 CFAF/m3 to the village.

Remarkably, these examples and others (MINEF-DFID, 2004) are essentially concerned with the exploitation of timber, to which a great value is attached. Sunderlin (2006) has incidentally underlined this fact, by stressing the necessity to locate CF where there are abundant forests. In reality, most of the CFs are usually seated in areas that have already been exploited, therefore deprived of sufficient valuable timber species.

In the North-West province, due to the scarcity of timber, communities have placed the focus on non-timber forest products as a source of revenues from community forest (Gardner *et al,* 2001).

Vabi *et al* (2002), who have carried out a cost-benefit analysis of the community forestry across three agro-ecological regions in Cameroon, show that revenues generated in the non-timber forest products dominated region were contributing 2,800 FCFA (per adult and per year). This value however was by far inferior to that of the timber-dominated region (16,000 CFAF). This example has at least the merit to show that exploitation of community forest whether for timber or non-timber forest products is beneficial to the local population.

3. Study areas

3.1. Selection of study sites

Since the beginning of 2006, the project *"Improved certification schemes for sustainable tropical forest management"* funded by the Global Environmental Facility and performed by the Centre for International Forestry Research (CIFOR), the Forest Stewardship Council (FSC), and Proforest under a funding of the Global Environmental Facility has been launched in Cameroon. Its main goal is to study ways of implementing the FSC scheme for small forest

in Cameroon and more specifically in looking application of the principle n°9 on High Conservation Value (HCV) forests.

Against this background, three criteria have determined the choice of the study sites: (1) stake in conservation of the selected CFs, for instance through establishing high conservation value zones within the forest; (2) country regional representativeness taking into consideration CFs in the francophone and English-speaking part of Cameroon respectively; (3) CFs at a SMP implementation or revision stage, pointing up the relevance of an economic analysis.

Factors such as undertaking of research, existence of some literature in the selected CFs were also decisive in the final choice of the study site.

Two CFs have therefore been chosen namely: "*Coopérative des Paysans et Agriculteurs de la Lékié*" CF (COPAL CF) in the Centre province (francophone zone) and Bimbia Bonadikombo CF (BB CF) in the South-West province (English-speaking zone). The figure 1 shows the location of the study sites in Cameroon.

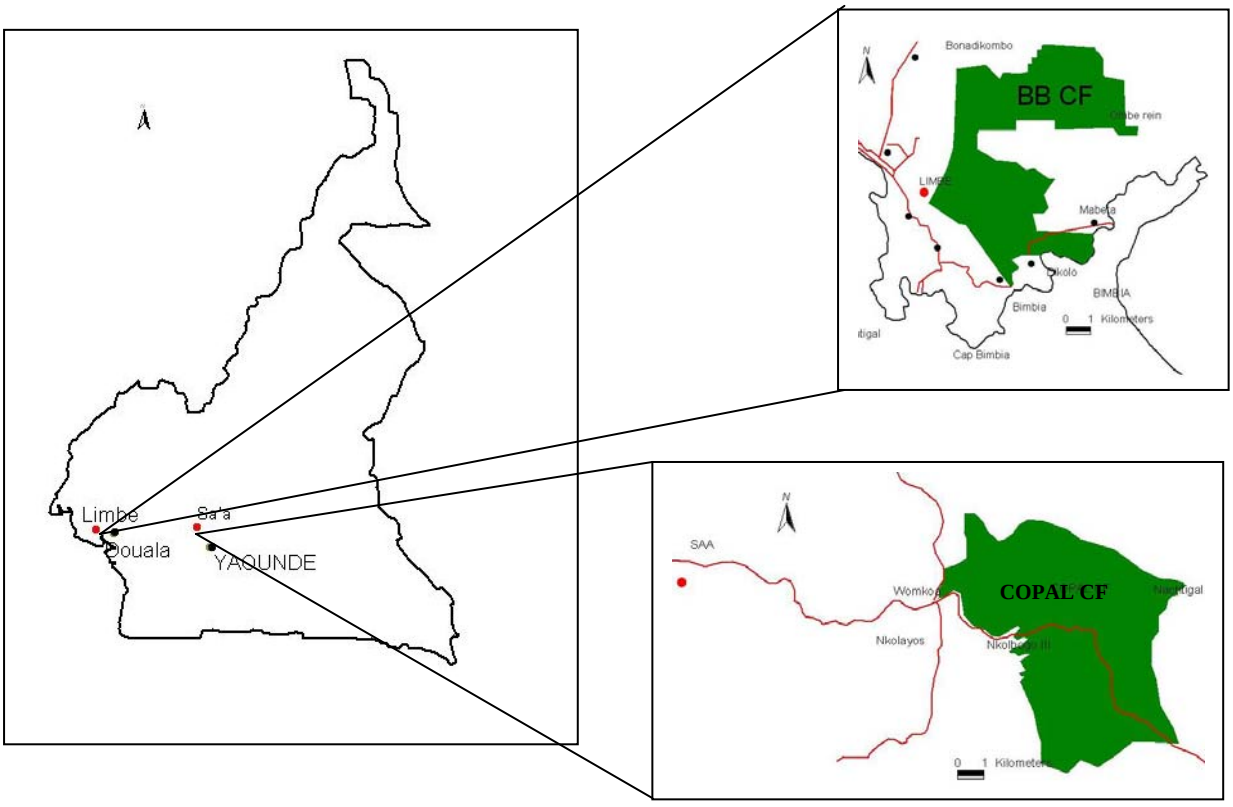


Figure 1: Location of BB CF and COPAL CF in Cameroon

3.2. COPAL community forest area

Physical environment

The community forest is found in the Province of Centre, Division of Lekie, Sub-division of Sa'a, and the district of Batchenga.

The COPAL CF covers a total area of 4800 ha and is characterized by a flat topography with only few hills of low amplitude, the highest one Nkolopia culminates at 565m. Though, presenting a regular terrain, some ridges appear to the nearside of rivers. The altitude of the forest regions ranges between 750 m and 800m.

Soils are ferralitic consisting of muscovite-based minerals and coarse fragments from the bed rock. The soils are very rich in humus and opportune to farming activities. The hydrographical network of the region is dense, with one big river, the Sanaga and some small rivers such as Afamba, Nala, Idiba, and Bologo.

The vegetation consists of savannah and secondary forest, occupying about 70% and 30% of the land respectively. Trees most frequently encountered in the forest are *Tryplochiton scleroxylon, Lophira alata, Terminalia superba, Diospyros crassiflora, Milicia excelsa.* Grasses and shrubs are predominant in the Savannah.

The forest is located in the climate zone of equatorial type with four seasons namely: one rainy season from August to November and a second rainy season less heavy from March to June; one dry season from December to February; and a second dry season from June to August. The temperature varies between 20 and 24°C. Rainfall averages 1550 mm annually.

Human environment

The community concerned by the CF includes 10 villages, namely: Nkolevodo, Biyaga, Ondondo I, Ondondo II, Ondodo III, Womkoa, Nkolbogo III, Famnassi, Nachtigal, and Nalassi.

The socio-economic survey carried out in May 2006 in the course of the SMP preparation has estimated the population at about 5000 inhabitants. Most of these people are dependant on the forest to sustain their livelihood. Several activities are undertaken by local population to satisfy their daily needs, including *inter alia*: agriculture, timber harvesting, non timber forest products collection, subsistence hunting, fishing etc.

Subsistence agriculture is one of the main activities taking place within the CF area. As a common feature of the southern humid forest zone of Cameroon, the agricultural system practiced is shifting cultivation. Most of the farming produced is dedicated for consumption and the production surplus sold, although this trend is gradually subject to change. Land are exploited for 1 or 2 years, and then left behind for fertile land or nutrient-reconstituted fallow. Fallow period ranges between 2 and 5 years. Food crops commonly found include: cassava, cocoyam, banana/plantain and groundnuts. Secondary food crops are maize, pepper, cucumber.

The region has a long standing reputation about cocoa production, which constitutes an important source of income for local people. However, crop such as palm tree are increasingly being introduced by farmers.

Inputs such as fertilizers or pesticides are often not used due to the lack of capital, as a consequence post-harvesting loss are considerable.

Historically, though the COPAL CF has not experienced an industrial logging, its forest cover has been subject to serious degradation caused by cocoa plantation expansion and informal small-scale timber harvesting. Timber exploitation is concentrated on two high-value tree species: *Milicia excelsa* (Iroko) and *Afzelia bipindensis* (Pachyloba), which are becoming gradually scarce nowadays.

A great deal of NTFPs is collected from the forest reflecting their importance for the population. Though their uses are varied, medicine and food remain the main utilizations. Some of them such as Njanssang (*Ricinodendron heudolittii*), Gnetum (*Gnetum africanum*) have an economic importance for the local community. This activity is basically the fact of women and children. Hunting is mainly carried for subsistence purpose and petty trade at the village level. The degradation of the forest has had an adverse incidence on the relative abundance of games within the forest.

3.3. Bimbia Bonadikombo community forest area

Physical environment

Bimbia Bonadikombo forest is located on the western foothills of Mt. Cameroon to the West of Limbe in the Fako division. The BB CF is about 3735ha from which 1229 ha in the southern part have been set apart for conservation purposes. The geology is of old volcanic rock and the soils are of old lateritic type. The area is marked by steep slopes, ridges and

valleys running from south to north. Many of these valleys are drained by separate seasonal and permanent streams, and by four main rivers, the Mabeta, Elephant, Mamba and Esuke rivers running eastwards and two other rivers running southwards into the mangrove at Dikolo Bay.

Most of the BB CF under forest (especially the southern part) is of high ecological value principally for its diverse flora of rare, endemic and endangered plant species. It is still the only site know in Africa to have the plant *Oxygyne triandra*. Although most of the wildlife has been lost through excessive hunting and the destruction of habitat, the area still retains interesting birds and butterfly faunal species (ERM, 1998) and two threatened monkeys, the red-eared guenon and the putty nosed guenon are believed to be present (BB CF SMP, 2002).

BB CF is characterized by five main vegetation types which are: lowland rainforest, secondary disturbed lowland rainforest, freshwater stream and river bank vegetation, swamp forest, coastal vegetation and mangrove. Particularly for this latter, Tchouto *et al*, (1998) have reported a high human pressure since it is felled and used mainly for fish smoking at Mabeta fishing port, Bimbia and Dikolo villages.

Rainfall, temperatures and humidity are high (4000-5000 mm). The climate is tropical monsoonal with a monomodal pattern.

Human environment

The BB community is a complex of many villages namely, Mbonjo, chopfarm, Bonagombe, Bonabile, Dikolo, Mabeta, Bamukong, Bonadikombo and Moliwe CDC camps.

As a result, a population of about 123.900 (RCDC, 2002) depends directly or indirectly on the forest i.e. Limbe and its surrounding towns. It is interesting to note that demands in the BB forest are made by many different groups of people. Indigenes (mostly Bakweri) have been found less involved in the utilization of the forest than the migrants in majority native from the Northern and Western Province of Cameroon.

The dampening economic climate and increasing population of the surrounding settlements has meant that the demand for forest products in the area is increasing (Oji et al, 1998). Now most of the forest is relatively degraded (particularly the northern part – Moliwe) through human activities (farmers, chainsaw operators, hunters, firewood collectors etc.).

Most of the land in BB is on lease with the Cameroon Development Corporation (CDC). However, some individuals have claims to certain areas, reflecting the conflicting context between *de jure* rights and *de facto* rights about the land tenure in this area.
The farming system implemented is shifting cultivation. Plantains and cocoyams are the dominant crops with maize and cassava appearing on older farms. Though relatively scarce, some fields of cocoa and coffee are scattered throughout the forest. A typical feature of the agricultural landscape is the existence of pockets of farmland alternating with forests known as 'head farm'. Fallow periods have drastically reduced over the time and are disappearing (Eyong, 2001).

BB forest has experienced several waves of timber exploitation namely, industrial logging, small-scale timber exploitation by chainsaw owners. This explains the fact that high quality timber that used to be there a couple of decades ago, such as Iroko, Mahogany are now relatively scarce. Since then, forest exploiters have increasingly resort to a diversified assortment of timber species including several secondary species such as *Staudtia stipitata* (know as small leaf). The proximity of the forest to Limbe offers a ready access to the domestic market. In spite of the monitoring patrols undertaken within the CF, there is still a rampant illegal timber activity.

One of the main uses of the BB CF is for charcoal production. This activity is basically based on exploitation of ironwood tree (*Lophira alata*). Firewood is also highly used in the area, mostly for fish-smoking. Firewood collectors mainly operate illegally and very often they work at odd time to escape forest patrols.
NTFPs are used as a priority for subsistence purpose. Forest products such as *Gnetum africanum* have become very rare in the area as a consequence of overharvesting.

4. Theoretical framework and methods

4.1. Theory of economic analysis

The developments made in this section are essentially based on Gregersen *et al* (1992) and the compilation of the economic lecture notes (Olschewki, 2007).

Economic theory has been founded on the notion of a rational individual, that is, a person who makes decision on the basis of comparison of benefits and costs (Brent, 2006). Therefore,

undertaking an economic analysis of forestry projects essentially aims to compare costs with benefits and determine which among alternatives projects yield the best returns. Davies and Richards (1999) have divided the range of economic methods used for policy evaluation, project selection and appraisal into three methodological approaches including: (1) economic and financial cost-benefit analysis (CBA), (2) environmental analysis, and (3) participatory economic analysis. For the purposes of determining the magnitude of benefits and cost accruing to a local community as a result of implementing community forest projects, the financial and economic CBA was chosen as more comprehensive framework.

CBA is rooted in the welfare theory. The criteria used are based on the Kaldor-Hicks principle of potential compensation. The principle states that if gainers from an action could compensate the losers while there is still some benefit left, the action is an improvement regardless of whether compensation is actually paid. In the case this potential compensation is effectively paid the principle is actually the Pareto-criterion (Hanley and Spash, 1993).
Generally, this investment tool is used where public intervention is required and therefore has the purpose to check projects for efficiency and to facilitate rational decisions against the back-ground of economic scarcity (Olschewski, 2007).

There is an important principle that has to be kept in mind in this report: 'the with/without principle'. The concrete effects of a community forest project can be defined as the difference between the situation 'with project' and 'without the project'. The situation 'without project is not necessarily' the same as the situation before the project started. This is because the situation can change in time even without project. Especially for forest projects that generally have a long time horizon, the before/after principle in ignoring potential changes from the status quo might lead to significant under- or overestimation of project costs and benefits.

According to Prest and Turvey (1965, p.686 cited in Brent (2006)), who define the CBA process as "*maximize the present value of all benefits less that of all costs, subject to specified constraints*", CBA seeks to maximize the welfare. The difference between benefits and costs is the efficiency effect of the project.
However, caution must be taken when we come to the point of answering whose welfare is to be maximized. The answer to this question will differ whether we consider it from individual private firm or government decision-making perspective. Hence, the distinction must be made between financial and economic analysis.

Whereas economic CBA considers the use of forest land in terms of the net economic benefits to society, financial CBA looks at private benefits and costs. The costs and benefits used in the financial analysis are those actually incurred or received by the farmers or other local stakeholder groups. Economic analysis is essentially interested in prices which reflect opportunity costs known as shadow prices, as opposed to financial analysis that draws on market prices. It is important that project evaluation be undertaken not only based on the financial returns that will accrue to participants, but also with a goal to determine advantages that accrue to the whole society. Any privately profitable but socially unprofitable land use would lead to inefficient use of scarce resources, leading to resource degradation and poverty (Pagiola, 2001).

Although extensively used in both public policy and private investment appraisal, CBA has been subject to abundant counter-arguments. Its adequacy has therefore been questioned given its limitation in determining non-economic values, its limitation to incorporating distributional equity, including intertemporal equity and its vulnerability to political influence (Omura, 2004). The often recurring critic is certainly that CBA fails to explicitly account for distribution of benefits in the society. Byron (1991) points up this concern, in questioning the legitimacy of employing CBA techniques in situations where distributional equity issues are of primary concern and probably the key to project success. However, in spite of these shortcomings, some scholars (Hanley and Spash, 1993; Brent, 2006) have proposed improvements that have lead to some advancement in CBA measures in recent years.

4.2. Structure of economic analysis

Gregersen and Contreras (1992) define basically four main steps used in answering both financial and economic efficiency questions, namely:

- Identifying and quantifying inputs and outputs;
- Valuing inputs and outputs;
- Conducting the analysis;
- Dealing with uncertainty: sensitivity analysis.

Before to start running the economic analysis, some prerequisites need to be fulfilled that deal with identification of the relevant constraints that can prohibit success of alternative projects. These constraints include *inter alia* (Olschewski, 2006):

- Physical constraints that deal with the technical and natural relations between production factors and the good produced. Production factors being labour and capital. At this stage all type of factors - either of environmental (unavailability of land, climatic hazards, etc.) or production nature - likely to hinder conducting of the project should be identified and ways to overcome it explored.
- Financial constraints are related to the financial scale set up by politicians, following results of the economic analysis. In some circumstances a CBA for a given project may display costs exceeding the financial constraints, while at the same time a particular high benefit is generated. Relaxing of financial constraint at that time is at the hand of decision-takers to render the project possible.

- Juridical constraints are those related with the necessity to comply with national laws. Thereby, it can happen that a project having a positive welfare be rejected because of its non-compliance with national laws. CBA will therefore indicate the economic loss caused by existing regulations.

- Administrative constraints which have to deal with the degree of capacity and capability of responsible authorities. Organization of administration, conferring regional structure a high level of decision-making, may reject certain projects, even though of national interest.

- Political constraints which take into consideration political targets and development strategies, that are not necessarily the main focus of the project, and may lead to its rejection because it does not fulfill certain qualitative or quantitative minimum requirements.

4.2.1. Identification and quantification of inputs and outputs

Identification of inputs and outputs of the project is a critical step in project analysis.
The first task is to identify project components that can be analysed separately. That means, the components under analysis should display inputs and outputs that can be analysed as separate entities with regard to the cost and benefit relationship.
Gregersen *et al* (1992) distinguish between direct inputs and outputs and indirect effects of the project in the identification procedure. Direct inputs and outputs are central to both economic and financial analyses of a project, since they are the most important in terms of total project costs and benefits. Accordingly, direct inputs generally include items such as labour, capital equipment, raw materials, land, etc. that are required to run a given activity in

the project, while direct outputs refer to the goods produced such as fuelwood, timber, fodder, etc.. Contrarily to the direct inputs and outputs, the indirect effects cannot enter into account in the financial analysis, since it is not directly bought or sold within the project context. Though their appropriate valuation in monetary terms sometimes poses problems, it is however suggested that they should still be identified in quantitative physical terms. These indirect effects are inherent in the intrinsic nature of forest. In effect, the value of forests depends not only on the market prices of its direct uses but is also based on other indirect uses of the forest that cannot be traded on some kind of market.

Following the typology of Pearce *et al* (1989), forest benefits may be grouped into general categories as in table 1.

Table 1: Types of forest value

Use Values			***Non-Use Values***
1. Direct Use	*2. Indirect Use*	*3. Option*	*4. Existence*
Wood products (timber, fibre, fuel) Non-wood products (food, medicine, genetic material) Educational, recreational & cultural uses Human habitat Amenities (landscape)	Watershed protection Nutrient cycling Air pollution reduction Micro-climatic regulation Carbon storage	Future direct and indirect uses	Biodiversity (wildlife) Culture, heritage Intrinsic worth Bequest value

The study is mainly interested in some of the direct and indirect use values which seem to bear more meaningfulness, for an analysis carried out from the perspective of a local community.

Finally, the procedure generally ends with the preparation of a table that depicts monetary inflows or outflows during the term of the project.

4.2.2. Valuation of inputs and outputs

The valuation procedure simply entails to associate corresponding prices to the inputs and

outputs identified in the first step. For the financial analysis, the prices used are those actually found in the market. Though some overlappings might occur with the economic analysis, the difference with the financial analysis generally results from the limits of market prices to adequately reflect social or opportunities foregone by the project's uses of resources. The fact that the project life is commonly more than a single year will necessitate the analysis to take into consideration: trends in prices and forecasts or projection of future prices.

Working with market prices over the life of the project implies dealing with inflation. Two types of prices may be used: on the one hand, 'relative prices' or 'real prices' that allow analysis to be undertaken based on existing prices as a measure of future prices, and on the other hand, 'nominal prices' that integrate the inflation rate.

An important point is related with estimation of relative price change. In case where analysis deals with goods such as timber, it is likely that its price changes over the project life. However, as underlined by Gregersen *et al* (1992), forecasting can prove to be quite complicated to carry out in practice if it is to be done properly.

In some cases, market prices provide adequate estimate of the people's willingness to pay (w.t.p.) for goods and services commonly sold on markets. However, when market prices prove to be inadequate to reflect w.t.p. or simply do not exist, shadow prices should be developed.

Developing shadow price is not systematically done for each inputs and outputs. Gregersen *et al*, (1992, p.72) appeal to a rough rule of thumb, quoted this way "*if an input valued in market price terms represents 5% or more of the total present value of the cost of the project, then it is a logical candidate for shadow pricing to determine its economic value*". In a similar fashion according to the same authors, as a rule of thumb, the development of shadow prices is usually required for: (i) anything imported or exported (anything that involves the expenditures of foreign exchange, especially if the exchange rate is artificially pegged); (ii) anything subsidized or bearing fixed prices (any good or service to be used in the project that is currently subsidized such as production and sale of seedling in nurseries); (iii) Labor if there is a chronic unemployment or underemployment in the country.

Brent (2006) suggests the use of accounting ratio to calculate the shadow price. The formula is denoted as follows:

$$Accounting\ Ratio = \frac{Shadow\ price}{Market\ price}$$

This approach seems practical when considering time and resource limitations one has to spend in shadow pricing costs and benefits. In some cases, one accounting ratio for one item in a group of products studied may be representative of all, and help calculating their shadow price. Though the discipline of environmental economics has designed a great deal of techniques in the development of shadow prices, for certain non-marketable goods it may appear difficult to develop them. In this case it is appropriate to describe the effects in physical and/or qualitative terms and suggest how they are likely to affect the project outcome and its impact to society.

For this work, the modifications made to the financial model for the economic analysis are related to the prices, costs and the total welfare transferred to the society:

(i) for the labour in considering the economic price to be 50% of the financial price to take into account rural underemployment;

(ii) A Standard Conversion Factor of 0.9 is applied to non-tradable items. It is conventionally assumed that customs barriers outbid the price by 10% comparatively to a situation of trade. This being particularly relevant for the case of the Economic and Monetary Community of Central Africa.

4.2.3. Conducting analysis

After identifying inputs and outputs, associating them a value, the next step is to compare the costs with the benefits generated, so that one may objectively determine the best alternative from the viewpoint of financial and economic efficiency.

A cash flow (net payment or income) table is in general calculated using annual estimated costs and returns. It is however worthwhile to note that the presentation of the cash flow table will slightly differ for financial and economic analyses. In principle, the economic cash flow table actually represents the total value flow table. Therefore, account is made of all the costs and benefits that are not included in the financial cash flow table; some prices are re-evaluated by the means of shadow prices; and transfer payments (taxes, subsidies, repayment of loans and interest) are removed from the cash flow table while differences in timing of economic and financial costs and economic benefits and financial returns are adjusted. In this report the economic analysis take into consideration total production, whereas financial cash flow only encompasses the sold part of the production.

These rules are particularly relevant when the value flow table is derived directly from the cash flow table. Once the cash flow tables have been prepared, the basic steps inherent to the analysis can be performed.

• *Discounting*

Forest projects spread over a substantial number of years. Effective account of the time factor in the analysis is done through discounting. Since costs and benefits of a given project occur over the life of the project, their appropriate comparison should be made at a common point of time. This is because money has different value according to when it is received or paid out: people prefer money today to money in the future. Therefore, discounting future flows of costs and benefits back to the present is necessary in order to compare projects or land uses with costs and incomes that occur at different times in the future. In this way future sums can be converted into present value and vice versa. The present value of a future cost or benefit occurring in the future n years from now can be expressed as:

$$PV = \frac{Vn}{(1+r)^n}$$

Where:

PV = Present value

r = discount rate

n= number of years

V_n = Value in year n

For a series of values spread over a number of years (T), it is possible to calculate the present value of all that may stand to represent the present value of all costs (PV(C)) or all benefits (PV(B)). This is the sum of the present values of each value, expressed as:

$$PV_{all} = \sum_{t=0}^{T} PV_n = \sum_{t=0}^{T} \frac{Vn}{(1+r)^n}$$

An important component of this formula is the discount rate (r) which represents the time value of money. It measures how people value present as opposed to future consumption. It shows how much they are willing to sacrifice or trade-off benefits in the future in order to secure benefits. Higher the discount rate, the higher the emphasis on present consumption. The real personal discount rate known as the time preference is most often high, this typically

for forest-dependent communities. In contrast the social discount rate used at the national level is below the private rate (Pearce *et al*, 2002).

To properly discount, the analyst is very often confronted with the choice of an appropriate discount rate.

The appropriate discount rate should reflect the 'time preference rate' of the person receiving the costs and benefits. For public investments, the rate of interest on alternative investments or the cost of capital can be used. This is because the society is able to spread risk across a range of activities and regions and can thus afford a longer-time horizon that can encompass conservation objectives (Davies *et al*, 1999).

The discount rate of the farmer is often difficult to determine. In effect, activities in which he is involved may present differences in term of resource uses, risk and returns whether in form of cash income or non-marketed benefits resulting in different discount rates.

Approaches one can use to determine a farmer discount rate include actual borrowing rates, or the rates of return that farmer can get from investing their time and money in alternative production activities. However, these approaches are difficult and have their limitations.

In any case, the discount rate selected for the analysis should be based on the combined factors of expected return and risk.

From the above, determining discount rate is a tricky task, and most often sensitivity analysis stands as the way the analyst can identify profitability dependent on farmer and community time horizons. However, the issue related to a general agreement among economists and policymakers on the determination of an appropriate derivation of the discount rate is still on the agenda, as long as the question on who decides on the discount rate and on what basis will remain unanswered.

Just as working with prices requires for the analyst to deal with inflation, the same applies for discount rate. When using a given discount rate, inflation is to be considered in the analysis. There are two methods of calculating the present value of a future sum. The first is to discount the sum by "the nominal rate of interest". The second is to remove the inflationary estimate from the projected sum, and then discount that sum by the "real" rate of interest i.e. the nominal rate after the rate of inflation has been removed. Economists generally prefer to use the real interest rate approach for discounting. The primary reason for this is that real interest rates tend to be much more stable and, therefore, much more easily predicted, than either

inflation rates or nominal interest rates (Spalding-Fecher, 2000). The formula of the real interest rate is expressed as follows:

$$i_t^r = \frac{i_t^n - \pi_t}{1 + \pi_t}$$

Where:

i_t^r = real interest rate

i_t^n = nominal interest rate

π_t = rate of inflation.

• *Decision-making criteria*

CBA determines the project worth by reference to a number of decision-making criteria or measures of project worth. It is important to note that there is no single measure of project's worth which is universally accepted, since all share the characteristics of providing only partial information of project performance (Gregersen *et al*, 1992).

Some criteria of decision commonly used in project analysis include:

- *The Net Present Value (NPV)*, which is the difference between the total discounted benefits PV(B) and total discounted costs PV(C). The formula of NPV is expressed as follows:

$$NPV = PV(B)\text{-}PV(C) = \sum_{t=0}^{T} \frac{B_t}{(1+r)^t} - \sum_{t=0}^{T} \frac{C_t}{(1+r)^t} = \sum_{t=0}^{T} \frac{B_t - C_t}{(1+r)^t}$$

A positive difference indicates that the benefits generated by the project exceed the cost. The project is advantageous. The amount of the net welfare effect is given by the NPV.

- *The Benefit-Cost Ratio (BCR*), which is the ratio between total discounted benefits (PV(B)) and total discounted costs (or between undiscounted benefits and costs). The BCR is formally expressed as:

$$BCR = PV(B)/\ PV(C) = \frac{\sum_{t=0}^{T} \frac{B_t}{(1+r)^t}}{\sum_{t=0}^{T} \frac{C_t}{(1+r)^t}}$$

A BCR greater than 1 indicates that the project is advantageous. The use of BCR for purpose of analysis requires an exact separation of costs and benefits, what is not the case for NPV. While it will indicate whether a given project is worth undertaking, it can give a misleading ranking of mutually exclusive projects of different scales. This is because BCR provides different results depending on varied interpretations of costs and benefits.

- The Internal rate of return (IRR), which is the discount rate (z) which equalizes the present values of costs and benefits. Its formula is expressed by:

$$NPV = \sum_{t=0}^{T} \frac{B_t - C_t}{(1+z)^t} = 0 \qquad \text{and} \qquad \sum_{t=0}^{T} \frac{B_t}{(1+z)^t} = \sum_{t=0}^{T} \frac{C_t}{(1+z)^t}$$

A project is recommendable, if the IRR is higher than the level of a certain reference interest rate. A problem that often arises is to decide whether to take individual or social time preference, the opportunity cost rate or a synthetic discount rate as reference level.

4.2.4. Sensitivity analysis

Forestry projects are subject to a wide variety of risks and uncertainties. Therefore it is imperative to deal with uncertainties in the analysis. Sensitivity analysis evaluates how changes in estimated variables such as benefits, costs, and discount rates affect the outcome of the analysis. It is important to vary some of the key parameters between acceptable limits (eg. -25% and +25% of the basic assumption).

One way to account for the risk factors into the discount cash flow analysis is to use an increased discount rate, which reflects the added yearly risk of a forestry investment. The other way is to adjust cost and benefits in the calculations to evaluate a variety of best and worst case scenarios. Elevitch and Wilkinson (2000) provide examples of varying some key estimates:

- increasing the projected cost of labour;
- using higher costs if the exact cost of an operation is not adequately known;
- Being conservative with tree growth rates and timber yields;
- Being conservative with wood prices;
- Using a higher discount rate in the analysis to reflect a greater conservatism in the use of money;

By varying key factors one at time can help gauge the risk.

4.3. Research methodology

4.3.1. Research design

The field study was conducted from May 2007 to August 2007. Introductive meetings were meaningful to seek co-operation from the leaders of the CFs and the local population, to explain the purpose of the survey and to agree on dates of the beginning of the interviews. During these reconnaissance visits, which lasted about 3 days for both study sites, it was possible to familiarize with the socio-economic context of the study, to polish up the questionnaires, to identify key informants and to identify the setting-up of our sample.
Structure interviews were deemed necessary for certain activities namely farming activities and NTFP collection that are undertaken by most of the households in both communities.
Due to time and costs constraints it has proved particularly difficult to create a sampling frame. The approach therefore adopted to turn round this situation was the two-stage-technique involving the selection of primary sampling units or clusters (villages) and the subsequent drawing of units (head of household, NTFP collectors) from each clusters. The clusters were selected from a comprehensive list of villages with probability proportional to estimated cluster size (for further details see Carletto, 1999). Socio-economic reports on the COPAL and BB communities (COPAL SMP, 2007; Nuesiri, 2007) have provided relevant information about the total number of villages and households in each study area.

In the COPAL community out of a total number of ten villages totalling 654 households, a random sample of 100 households was randomly selected using the approach earlier described. While in the BB CF out of a sample of 1122 households, 150 households were randomly selected. The structured questionnaires (cf. annex 1) were administered to the sampled farmers by trained enumerators. The questionnaires elicited information on household socio-economic characteristics, farming information, type of products and quantities they extract from the forest and the costs they incur. Out of the interviewed households a total of 98 and 120 respectively for COPAL CF and BB CF were included in the final analysis.

4.3.2. Data gathering methods

The approaches used to collect data depend on the type of data concerned. During this research, secondary and primary data were collected.
Secondary data were obtained through review of literature, project documents and records of COPAL and BB legal entities, database statistics available. Data on forest and socio-

economic characteristics, fishery values, carbon sequestration, economic information (discount rate, change of timber relative price etc.) were derived.

Primary data were collected through the means of household surveys using structured questionnaires to determine community livelihood from the CF, particularly concerning farming activities and collection of NTFPs.

A range of Rural Appraisal tools were used during the field research namely:

- Forest transect walk and direct observations in order to construct a right picture on the existing forest cover and the extent of farmland in the zone.
- Consultative meetings with group of leaders to determine potential alternatives of implementation of the SMP. It is worth noting that this has sometimes revealed to be a complex exercise to the local community, for which anticipating future direction of the management of their forest is not a common exercise.
- Group discussions with Common Initiative Group (CIG) in COPAL and existing associations of forest user groups in BB CF to determine costs and benefits and the constraints presently associated to the execution of their activities.
- Interviews with key informants in the form of semi-structured interviews with individuals who were knowledgeable about the recent development of their CFs. In this sense, meetings with the forest manager in BB CF and a development leader in COPAL were instrumental.
- Market visits to investigate prices and take weight measurements of some food commodities.

4.3.3. Analytical procedures

The analysis of data has essentially drawn upon Microsoft Excel applications of financial analysis. The Statistical Package for Social Sciences software, version SPSS 12.0 was also used to perform statistical descriptive analysis of the farming survey data.

4.3.4. Data analysis

The analytical approach adopted in this paper consists of the following:

Time horizon

The time horizon used in this study is 25 years. It is the period during which the SMP should be implemented for the two CFs. Thus, it is interchangeably referred in the report as the project life or the rotation.

Discount rate

The discount rate used to obtain the present values of the net benefit streams has been determined as follows.

According to the recent steps of the Bank of Central Africa States, commercial banks in Cameroon apply an average annual deposit rate of 5% and 15% for money borrowers (OECD, 2007). The average of the two interest rates 10%, is used to calculate the real interest rate considering a 5,1 % annual inflation rate in 2006 (National Institute of Statistics, 2007). The real interest rate is therefore calculated according to the formula earlier mentioned.

$$i_t^r = \frac{i_t^n - \pi_t}{1 + \pi_t}$$

The real interest rate obtained is +4,6% rounded up at 5%. This discount rate may appear to be relatively low with regard to the farmer actual perception of the money value. Sensitivity analysis will therefore be an appropriate tool to integrate the farmer risk behaviour by varying the discount rate.

It has been a tricky issue during this research to found the current Government of Cameroon's social opportunity cost of capital. Indeed, specialized governmental institutions responsible of planning and programming of investment projects at the national level were not able to provide me with the required information. Nonetheless, a review of some literature about social discount rates used in economic studies show values ranging between 3% and 12% (Howard, 1995; Yaron, 2002; Ruitenbeek, 1989; Lescuyer, 2000; Yakobo 2006). According to the data provided by the International Monetary Fund (IMF-online, 2007), the social discount rate has undergone a steady decrease since 1999 (7,30%) to reach a value of 5,25% in 2006 (OECD, 2007). This discount rate (~5%) is already adjusted net of inflation, as such it has been considered for the purpose of economic analysis. Here both the financial and economic analysis CBA used the discount rate of 5% and assume a 25 year planning horizon. All the calculations here are normalized to real values of 2007 CFAF[2].

Timber stock assessment

i) COPAL CF

The volume of standing timber has been determined on the basis of the forest inventory data provided in the SMP. For the purpose of the analysis, the tree species have been categorized into four groups, namely hardwood (first and second category) and softwood (first and second

[2] The conversion rate of the CFAF into US$ denoted here as $ is : 1$ = 500 CFAF

category). Further on, the exploitable volume has been adjusted to reflect a situation with increasing scarcity of first category hardwood (scenario 2). The table 2 summarizes the annual harvesting rate for a situation 'with implementation of the SMP' and a situation 'without CF'. A detailed list of the different tree species are provided in the annex 2.

Table 2: Volume of timber harvestable per type and category of wood in the COPAL CF

Type of timber	***Category of timber***	***Annual harvesting rate above MDE (m3/ha)***	***Total harvestable volume above MDE (m3)***	***Annual harvesting rate below MDE (m3/ha)***	***Total harvestable volume below MDE* (m3)***
Hardwood	1	0,20	948	0,41	1963
	2	0,93	4454	0,93	4483
Softwood	1	1,52	7302	1,60	7660
	2	1,20	5764	1,20	5764
Total		3,85	18466,50	4,14	19869,48

* Volume harvestable with a decrease below the Minimum Diameter of Exploitation (MDE) (from 100 to 70 cm and 80 cm to 60 cm) of some first category timber.

ii) BB CF

The stock of timber harvestable in BB CF is based on the 1992 and 1998 forest inventory carried out in this forest (LBG and rainforest conservation (1993); Tchouto *et al*, (1998)). In these reports, caution is made concerning the volume actually harvestable as most of the best stems are found on very steep or otherwise inaccessible ground. Further on, human activities like farming and illegal logging have gone on. It then seems realistic to take the annual exploitable yield as half of the current volume of commercial timber. On the basis of the data obtained the trees species have been divided into two categories namely hardwood and softwood.

Processing of timber into boards is mainly operated by the mean of an engine chainsaw. The log to sawnwood ratio used is 30% (Plouvier *et al*, 2003).

iii) Charcoal and firewood harvesting rate

Determination of harvesting rate for charcoal and firewood in BB CF has also drawn upon the same data source. Some hypotheses have been used for the determination of the number of trees to be harvested annually.

Annual production is expressed by the number of (1) the trees harvested for charcoal and (2) the bags produced.

The relevant data are provided by the 2006-charcoal permits which report the number of trees harvested this year. These data were cross-checked with the information provided by the charcoal burning association in the study site. Concerning firewood, the number of trees exploited per year, are derived from information provided by key informants. It is important to note that most of this activity is performed informally, without the grant of any harvesting permits. However, regular patrols have probably reduced the pace of this activity. This aspect is taken into consideration in the situation 'without community forest' (scenario 2). The table 3 gives a summary of the main elements of importance with respect to the annual production for charcoal and firewood.

Table 3: Annual harvesting related features for charcoal and firewood production in BB CF

Activity	***Figures***	***Remarks***
Charcoal production		
- average # of permits delivered p.a.	44	Delivered without real setting of quota by the legal entity (BBNRMC)
- average # of charcoal burners	22	
- average # of bags produced per tree	52	1 medium size tree produces about 52 stripes and 1 stripe tally to 1 bag
- average # of trees exploited per year	2	
- average # of tree in case informal/illegal harvesting	4	The production doubles
Commercial firewood collection		
Firewood collection		
One medium size tree	35 logs	1 log yields about 6 pieces
- average # of operators	9	
- average # of tree p.a.	6	Based on Oji et al (1998)
- average yield per day	20 pieces	Regular patrolling
- average yield per day	60 pieces	No real surveillance of the forest
- average # of trees p.a.	10	

<u>Specificities of the farming model</u>

Constructing a shifting cultivation model for the cost-benefit analysis may be a tricky task. The farming models in COPAL CF and BB CF concentrate mainly on two variables: (1) farmland size that varies linearly with demographic growth; (2) crop yield that changes as a consequence of decline in soil fertility.

Some more assumptions are set up:

- The farmland area is considered as one huge farm made up of many plots, like in Yaron (2002) for the Mount Cameroon area;

- The different farming tasks cover all the crops of the system (unless specific provisions are made). This assumption is consistent with Gittinger (1982), who considers that for

intercropped crops (e.g. maize and manioc) the allocation of cultivation time between crops is an arbitrary element.

- The yields estimated from the survey are considered to be the total output of this huge farm.
- Farmers complain about the continuous trend of the declining yields in the area. An annual decrease of the yield of 2% and 1% is used respectively for COPAL and BB CF.
- Annuals such as maize or groundnuts require the same amount of labour each year for the whole area while perennials like banana require new labour input only for the new farms.

Determination of some costs

i) Timber exploitation

The costs of the small-scale timber exploitation were given by the timber exploiters during interviews. Those costs have been cross-checked with some other studies (Fomete *et al*, 2001; Plouvier *et al*, 2003; Yeboa, 2005).

ii) Labour costs for farming and NTFP collection

Labour is the most important factor of production in the farming systems of the Congo basin and the humid forests of West Africa (Gockowski *et al*., 2004). Accordingly, labour was the most important variable input considered in the study. Only variable costs relating directly to the labour input were included in the analysis. These are the costs that would influence the profitability of the cropping production system (groundnuts-cassava and banana-cocoyam-based systems, NTFP collection).

For the calculation of the labour cost, Davies *et al* (1999) suggest that in situation where the labour market is not well developed, the price of labour is based on its opportunity cost.

During the survey, following Ambrose-Oji *et al's* approach (1998), farmers were asked to value the daily cost of labour for each task. Clearing was found to be one of the most labour constraining tasks, hence rated at high price in both study areas. Total labour costs are calculated by multiplying the person days required for each task by the reported rate for the task. As underlined by Yaron (2002), this method has the merit to reflect the perceived opportunity costs for each task and is an improvement on adjusting financial costs for shadow wages as a measure of economic cost. The average opportunity cost was 1000 CFAF person.day^{-1}, while the average opportunity cost of labour for NTFPs collection was 500 CFAF person.day^{-1}.

Prices

The prices used for the calculation of the benefits are market prices provided by key informants in some case or directly collected in the local market.

i) Change in the relative price of timber

Timber relative price is expected to increase over the life of the project with its declining availability. However, future timber prices are unlikely to grow rapidly (Pearce *et al*, 2002). A review of some economic studies (Rice *et al*, 1998; Sohngen *et al*., 1998) suggests a price increase that barely exceeds 1% *per annum*, two percent being the highest growth applied. Further on, Peck (2001), based on the FAO series points out the fact that the real price trend in the previous decades have not significantly changed in the 1990s. More recent developments about tropical sawnlog fob price trends (IITO website) indicate an increase of 2% for Iroko (*Milicia excelsa*) and 3% for Sapele (*Entandrophragma cylindricum*). This trend is based on the relative change of real price over the year 2005-2006. Following the above, it is reasonable to apply a modest price increase of 1% *per annum*.

ii) Price of food crop

The prices used in the analysis are farm gate prices.

The farm gate value of a cultivated product in agriculture is the net value of the product when it leaves the farm, after marketing costs have been subtracted (Wikipedia, online). Since many farms do not have significant marketing costs, the farm gate price is simply understood as the price of the product sold by the farmer.

Ecotourism

The basis for calculating the economic value of forest for ecotourism is the consumer surplus, representing the difference between willingness to pay and obligation to pay for the ecotourism experience. It was not possible to carry out the typical travel cost method to calculate the ecotourism value, because of the lack of detailed tourism studies in the study site. An indirect approach inspired from the study of Ruitenbeek (1989) in the Korup National Park, Cameroon, was therefore used.

Ruitenbeek estimated tourism benefits based on: 1) visitor projections, in assuming an incremental rate of visits from both researchers and tourists over the life of the project; 2) the typical expenditures and itineraries at comparable locations, in determining the average

visitor's expenditures for a given number of days in the touristic site. However, estimates obtained in this study case were however rather conjectural.

Carbon storage

The carbon storage value has been considered relevant to include in the analysis as it constitutes nowadays one of the highest valued services provided by the forest. Its importance has noticeably been exacerbated within the last few years with evidences and increasing public awareness about the threats associated to the global warming. Though the current commitments of the Kyoto protocol (2008-2012) do not specifically consider "reduced emissions through deforestation", an increasing number of stakeholders acknowledge today the necessity to integrate deforestation issues in the tackling of greenhouse gases emissions. In Cameroon, deforestation or forest degradation is primarily driven by smallholder agriculture (Grieg-Gran, 2006). Clearing of the forest for agriculture, will lead to a release of carbon dioxide which will contribute to accelerating the greenhouse effect and hence global warming. The quantity of CO_2 released to the atmosphere will vary according to the method of clearance and subsequent land uses.

The values of carbon stored are derived from Kotto Same *et al* (2000), where average values of tonnes carbon per unit area have been estimated for different land use types. The valuation is based on the cost of avoided deforestation. There exists a range of carbon estimates for the damage of carbon release ranging between \$7-30/tCO_2 (Lescuyer, 2000). Fankhauser (1994) suggests a central value of \$20 for damage of every ton of carbon released. Evidences from Costa Rica show a value of carbon credit at a fixed rate of \$10/tCO_2. The price of temporary certified emissions reductions (tCER) for reforestation or afforestation project has a much lower value than the current market price of Certified Emissions Reductions (CER) around \$5/tCO_2. From the above a conservative price of \$ 3/tCO_2 (1500 CFAF) has been chosen for the purpose of the analysis.

Fishing ground protection

Valuation of fishing ground protection is based on Ruitenbeek's methodology (1989). Admittedly, the valuation procedures used in this case are quite crude, but deserve attention as they convey an appreciation of the significance of this forest service. In the same connection, Bennet and Reynolds (1993) sustain this role of the forest in their case study, in warning the risk that weighs on the entire near-shore fishing industry in the Kuching Division of Sarawak as a consequence of mangrove conversion. The common link between these studies and

similar ones (Hodgson and Dixon 1988; Kumari 1995) is that they do not undertake detailed estimation or measurement of the offsite impacts of forest disturbance, but simply assume a damage function (IIED, 2003).

In the Ruitenbeek's case study, watershed protection benefits are valued in terms of fisheries. Two different but equally crude approaches are used to estimate the gross value of onshore and offshore fisheries, which are assumed to be entirely dependent on the forest. One estimate is based on the total capacity of the fishery, multiplied by the average market price, while the other is based on average national per capita income, multiplied by the total population engaged in fishing. The same approach has been adopted here to provide a rough value of the forest mangrove in the BB CF.

Another methodology would have required taking into consideration fishing costs (labour, capital, mangrove, equipment, etc.) in order to derive the net returns from fishing in the study site. However, time constraint and lack of data have prevented implementation of such a prospect.

5. Costs and benefits of COPAL CF scenarios

5.1. The CF history

The creation of the community forest was driven by the necessity to eradicate the anarchic exploitation of forest resource that was taking place in this area. Thus, the process to obtain a CF effectively started in mid 2001 with the creation of the legal entity in charge of the management of the CF, the COPAL cooperative. This management committee is made up of a board of representatives from the 10 villages concerned. Since then, the project has gone through several steps including the reservation of the CF (in December 2002), the preparation of the SMP (in 2004 and 2006) and recently its submission for approval to the forest administration. Apart from the active involvement of the local population, the project has benefited from the support of several partners.

Funding of forest inventories and socio-economic surveys, in view to the elaboration of the SMP has been made possible through the support of the Dutch Organization of development (SNV) and the RICG project. The COPAL is now awaiting the signature of the management agreement with the Government. The table 4 recapitulates the salient characteristics of the COPAL CF SMP.

Table 4: Main features of the COPAL CF SMP

Features	***Description***
Community forest area	4800 ha
Duration of the agreement	25 years
Phase	Pending of the signature of the management agreement
Land use plan	Cocoa farm (1143ha); Farm (701ha); Hills (19ha); Forest (1010ha); Savannah (843ha); Old fallow (584 ha); Young fallow (386 ha), village (115 ha)
Compartment (05)	compartment 1 (980ha), compartment 2 (967 ha), compartment 3 (965ha), compartment 4 (941ha); compartment 5 (947 ha).
Priority uses	Timber exploitation (harvesting defined on plot of 192 ha i.e.4800 ha/25 year. Trees located on farms, fallows, cocoa farm are included); NTFPs collection (over the whole area); Sand exploitation; agriculture (commercial food crop farm, e.g. banana farm of about 2ha); Artisanal fishing; Subsistence hunting.

5.2. COPAL CF scenarios

The main objective of this work is to make an economic analysis of the SMP. This document provides basic information on the 'how' the beneficiaries intend to manage their CF. Three scenarios have been identified for the analysis namely:

- Scenario 1: 'Strict implementation of the SMP', represents a situation where the community strictly complies with the provisions of the SMP; this situation is thought of as the base case.

- Scenario 2: 'Business as Usual', represents the situation 'without community forest'. Under this scenario, the forest land is used according to the exercise of *de facto* rights over the land tenure without formal supplementary requirements;

- Scenario 3: 'Adjusted implementation of the SMP', where the implementation of the SMP is mainly targeted towards realization of profits (whether in the short or mid-term) through undertaking of productive activities, such as timber exploitation.

Several activities are included in the SMP, but only few of them are considered to yield substantial differences in their benefits across the above-mentioned scenarios:

- Timber exploitation through production of boards with an engine chainsaw;
- Collection of non-timber forest products;
- Farming activities;
- Carbon sequestration has been integrated as an indirect benefit resulting from an appropriate management of the forest.

The remainder of activities such as sand quarry exploitation, fishery, and hunting are not likely to undergo a significant change with regard to the different management regimes under study. This is because, those activities are mostly operated for subsistence purposes, and therefore the SMP does not display any specific steps likely to impact them throughout the project.

5.2.1. Timber exploitation

Though the COPAL community is interested to promote conservation activities (e.g. through establishing of HCVZ), timber exploitation however remains one of (if not) the major activities through which they intend to derive profits.

Scenario 1: **Strict implementation of the SMP**

This scenario considers annual harvesting to be in conformity with the sustainable harvesting rate that is calculated according to the available harvestable stock of different categories of timber described in the SMP. Two groups of timber, first and second category are considered for the purpose of the analysis. These groups are thereafter distributed into hardwood and softwood. This grading is done based on the value local timber operators give to different types of wood.

Under this scenario, the annual rate of harvesting remains constant over the life of the project for all the categories of timber. A little exception concerns the second category softwood that does not have a well-developed market and is only likely to be harvested at a low pace in the starting of exploitation. Accordingly it is assumed that the second category softwood is exploited by half of the annual harvesting rate (1,18 m3/ha) for the first five years, and increased by 10% each of the following 5 year period. This scenario is feasible in a situation where the CF mostly targets its activities towards conservation and particularly if the stock of valuable stems is already considerably eroded.

Scenario 2: No community forest

In this scenario, the total annual harvestable volume increases as a result of a decrease of the DBH below the Minimum Diameter of Exploitation (MDE) (from 100 to 70cm, and 80 cm to 60 cm) for high valuable trees such as Iroko, or Bibolo. This results to a change in the annual volume harvestable per ha (cf. table 2, section 4.3.4).
This consideration has been introduced based on operators' answers, who in case of the scarcity of the resource, stated they would be able to decrease the MDE considerably.
The scenario simply considers timber harvesting to be performed as it has been done before reservation of the forest. Harvesting of tree species is selectively done, and mainly concerned the best stems of commercially valuable trees.

As long as volume of 1st category hardwood (HW) is still available, the rate of harvesting of second category softwood (SW) is assumed to be null. A little increase is induced only when the harvestable stock of 1st category HW is depleted. Then it is harvested at its normal harvesting rate.

Basic hypothesis: Annual harvesting of 1st category HW thrice the normal rate of harvesting since it reaches the level 0, then:
Secondary hypothesis:
- More 20% annual harvesting rate for 2nd category HW;
- More 20% annual harvesting rate 1st category SW;
- Harvesting of the 2nd category SW only when both categories above are completely depleted.

Scenario 3: Adjusted implementation of the SMP

This scenario is inspired by the reality of the local environment. In effect, though the COPAL CF is directed towards conservation objectives, many actors look at the forest as a source of potential income through development of small-scale timber enterprise.
However, the reality in the field is that a huge portion of the forest is made up of savannah, fallow and farms. So that setting up compartments as it is generally required in the SMP (i.e. 1/25 of the forest area) will hinder community to really extract substantial amount of timber likely to contribute to the realization of their local development objectives.

Hypotheses related to the rate of harvesting are accordingly set as follows:

- More 90% annual harvesting rate for HW 1st category, with gradual 10% drop each subsequent 5 year period up to the depletion of the exploitable stock;
- Same level of harvesting as above for SW 1st category;
- Less 50% of the annual harvesting rate for the HW 2nd category within the first five years of the project; and +20% increase of the harvesting rate each subsequent 5 years;
- Less 70% of the annual harvesting rate for the SW 2nd category within the first five years of the project; and + 20% increase of the harvesting rate each of the subsequent 5 years.

The table 5 summarizes the main harvesting hypotheses for timber exploitation in the COPAL CF.

Table 5: Timber harvesting hypotheses for the different scenarios in COPAL CF

	Evolution of annual harvesting rate over 25 year cycle (m3/ha/year)			
	HW 1st cat.	*HW 2nd cat.*	*SW 1st cat.*	*SW 2nd cat.*
Scenario 1	Constant	Constant	Constant	-50% first 5 years; +10% each subsequent 5 years;
Scenario 2	Thrice the normal rate, up to its complete depletion (0 m3/ha)	Normal before;+20% when HW 1st cat.= 0	Normal before, +20% when HW 1st cat.= 0	0 before HW 2nd & SW 1st =0, thereafter normal
Scenario 3	+90% first 5 years; -10% each subsequent 5 years	-50% first 5 year; +20% each subsequent five years	+90% first 5 years; -10% each subsequent five years	-70% first five year; +20% each subsequent 5 years

5.2.2. NTFP collection

As pointed out before, there is a wealth of NTFPs used by the local community in the COPAL CF. However the focus has been placed on few of them that constitute an important volume from the perspective of local consumption as well as commercialisation. Four plant-based NTFPs were particularly relevant in the frame of this study as their extraction rates are likely to change under different management alternatives, namely: Andock (*Irvingia gabonensis*), Njanssang (*Ricinodendron heudoletii*), Gnetum (*Gnetum africanum*), wrapping leaves hereby referred as Maranthaceae.

Sustainable exploitation of Gnetum and Maranthaceae has particularly proved to be problematic in the study area as both of them are subject to overharvesting. Brown (2005), who did an in-depth research on the trade of some NTFPs in this area, found that the increasing market pressures were having a negative effect on the availability of Gnetum in the forest. Pressure over the resource is translated through collection of Gnetum in fields, fallows or plantations where the plants are small and have not yet grown into vines. Continual

harvesting from such small plants reduces the vigor of the plants and stunts its growth. This finding can be justifiably extended to Maranthaceae, whose leaves are intensively used to wrap up a cassava-based meal (known as '*Ebobolo*'), a product highly commercialized in the study area.

Though Njanssang and Andock are heavily harvested in the study area, their harvesting is not likely to cause problems in the short term. However, there is a risk that juvenile recruitment could be reduced if the harvesting continues at current level or increases (Brown, 2005).

In addition, people interviewed recognized unanimously that they travel longer distances to collect the concerned NTFPs than a couple of years ago.

NTFP user groups have emphasized the need to harvest sustainably. As noted by Brown (2005) village people seemed to readily acknowledge that in the future their access to some NTFPs in the CF would be restricted. Though, such measures can easily result in social conflicts, sensitization efforts initiated by COPAL on this issue may yield a broad consensus at the community level.

According to the SMP, the goal of COPAL apart from encouraging sustainable harvesting of NTFPs, is to promote group marketing of the main NTFPs, so that women can obtain better prices. Evodoula, one village located in the same division provides us with a good example of this type of sale. Indeed, in practicing group marketing, village people have experienced a price increase on 0,5kg-bundle Gnetum from 150 CFAF to 650 CFAF within a period of three years (cso-cgiar-forum ADIE, online). Backing this experience, a marketing model developed for a group marketing enterprise in Boyo Division in northwest of Cameroon has indicated that the net benefits from the sale of cola nuts could be two- to three fold higher than current levels (Facheux *et al.* in press cited in Tchoundjeu *et al*, 2006). However, a word of caution should be stated, as grouped selling can have relatively high success in case where market access is difficult (i.e. poor road state, remoteness of the village from the existing market).

Scenario 1: Strict implementation of the SMP

As availability of Gnetum and Maranthaceae is gradually reducing, it is predictable that local community undertakes a certain number of measures towards their conservation.

Farmers' methods of conserving those NTFPs may include: collection of mature leaves on the vines; and/or preventing exploitation to 'outsiders' of any stand.

Undertaking sustainable harvesting of Gnetum and Maranthaceae will lead to a decrease of the current level of extraction. In this connection, it is assumed that annual current level of harvesting decreases by 20%, while current selling prices of the NTFPs under study increase by +25% as a positive effect of group selling. It is worth noting that this price increment is far below the examples mentioned earlier.

Scenario 2: No community forest

In this scenario, harvesting rate for Andok and Njanssang remains like in the previous scenario, as harvesting of these NTFPs even though intense are not typically destructive. The volume of Gnetum and Maranthaceae leaves harvested however tends to deplete gradually. Therefore, it is assumed a decrease by 25% of the annual harvesting rate every five year-period for Gnetum and Maranthaceae. The current price does not change, as it is directly occasioned by the execution of CF activities.

Scenario 3: Adjusted implementation of the SMP

Harvesting of NTFPs is undertaken at current rates. Once again, Andok and Njanssang do not pose any particular problem. Therefore, the same hypothesis of harvesting used in the scenario 2 is applied. The difference between this scenario and the scenario 2 is basically due to the change in price related to the group selling of different products. A summary of the different scenarios for NTFP collection is provided in the table 6.

Table 6: NTFP collection harvesting hypotheses for the different scenarios in COPAL CF

	Evolution of quantity harvested annually over 25-year cycle and change in price	
	Quantity change (kg/ha/year)	*Price change*
Scenario 1	-20% of the annual total production	+25% due to group selling
Scenario 2	-25% each five year period	No change
Scenario 3	-25% each five year period	+25% due to group selling

5.2.3. Farming activities

Analysis of farming activities is based on four major food crops cultivated in the study area[3]. Two main cropping patterns were identified namely: the groundnut-cassava-based system on the one hand; and the banana-cocoyam-based system. While the latter is mostly targeted in old fallow and the existing forest where it has proved to generate good yields, groundnuts-cassava farms are mostly opened in the savannah or in young fallows.

The rate at which the forest is opened under a given agricultural system may differ in function of the management regimes attached to it.

The current farmland size over the whole CF is estimated at 700ha (SMP COPAL, 2007), from which 40% is occupied by groundnuts-based farms and 60% by banana-based farms. In effect, if one household owns 1 ha, in average the subsistence food crop size is often about 0,25 ha while the rest cropped of banana-cocoyam mostly targeted towards selling will be 0,75 ha. During the life of the project an expansion of farms within the forest is to be expected. Since an annual expansion rate of farming is not available, it is assumed that farmland size increases as a linear function of the demographic growth (in Cameroon of 2,9%). Though the population-based explanations cannot alone bring clarity on the entire dynamic of farmland increase in the tropics (Ndoye and Kaimowitz, 2000), restraining the assumption to this indicator is necessitated by the difficulties to assess the impact of other underlying factors. Keeping in mind the farmland size (700ha), and the total number of 654 households for a total population of about 5000 inhabitants, the mean field size averages 1,064 ha. Evolution of farmland is therefore derived accordingly (cf. annex 3).

Another important factor that may have an impact on the level of crop production in the area is the construction of the Nachtigal dam. This fact is incorporated in each of the scenarios in estimating the increase in farmland area that may occur during the time of the dam building. According to the dam environmental impact assessment report (Tecsult, Sogreah, Alucam, 2006), about 600-800 workers will be involved in its construction. The project is expected to start by the end of 2007 and terminate in the beginning of 2012, with peak in the activity between 2008-2011. Therefore, with an influx of 600 workers, it can be reasonably assumed

[3] The division of Lekie has a long standing reputation concerning the production of cocoa, but it is deemed not necessary to analyze this system as it is likely to remain stable in the present conditions, following structural programs that cut subsidies and state services. Even in case of market rise prices a dramatic expansion of the system is not to be expected (Kotto *et al,* 2000). Moreover, if the farmer is motivated by prices incentives, the often-implemented practice is to replace the damaged trees. Establishing or not of a CF may not have a significant impact in the way this system may change.

that the field area will increase of about 150 ha. This area tallies to the average size of food crop field (0,25 ha), one of these new households will require for feeding.

Scenario 1: Strict implementation of the SMP

Implementation of the SMP may entail to reduce degradation of the forest area for farming. As pointed out by Waarde *et al*. (2006), '*clearing of the undergrowth or felling of trees is usually not allowed in a CF*'. A reduction of pressure on the forest resource is therefore expected. Accordingly, a decrease of 10% from the original banana-cocoyam field is therefore assumed.

Additionally we assume an annual decrease of yield of 2% due to decline in soil fertility. This percentage is however not applied to the farm newly opened within the forest.

Scenario 2: No community forest

In this scenario, the area dedicated to banana-cocoyam fields increases by 10% (i.e. surplus over the 60%) within the forest over the time.

Scenario 3: Adjusted implementation of the SMP

In this scenario it is assumed undertaking of farming according to the current practices. That means the current rate of establishing farm is maintained. That is 60% of the new farms opened within the forest. The table 7 provides a summary of the main hypotheses set up for the different scenarios.

Table 7: Farming hypotheses for the different scenarios in the COPAL CF

	Evolution of new farm sizes per year (ha/year)
Scenario 1	-10% of the current area of cocoyam-banana farms in the forest +10% of the current area of groundnut-based farm in savannah
Scenario 2	+10% of the current area of cocoyam-banana farm in the forest -10% of the current area of groundnut-based farm in savannah
Scenario 3	Current area (60%) of cocoyam-banana farm in the forest Current area (40%) of groundnut-based farm in savannah

5.3. Costs and benefits of the creation and implementation of the CF

- ***Costs***

The costs may be divided into two groups namely, the costs relative to the creation of the community forest (or cost of access to the resource) and those associated to the functioning of the CF. In both cases, most of these costs are fixed costs.

The costs of creation of the CF or costs of access to the resource are those related to the several stages that lead to the attribution of the community forest. The elements of cost include:

1) The preparation of the application file and follow-up of the procedure that covers:
- The information meeting (meals, invitation of the participants);
- The identification of the forest (mapping, instruction);
- The creation of the legal entity;
- The consultation meeting (announcement, official report, transport of administrative authorities, meals);
- finalising and duplicating the application;
- The forwarding and follow-up of the application file in the forest administration.

2) The development of the SMP, which covers:
- Forest inventory at 2% sampling intensity in the case of COPAL CF;
- Socio-economic surveys in the CF area;
- Checking of work by the district officer;
- Analysis workshop.

Some studies reported these costs to be in the range of 1,400,000 to 16,000,000 FCFA (Klein *et al* 2001; Njebet *et al* 2000, MINEF-DFID 2004). The difference in these costs is conditioned by the involvement or not of an external agent (such as a consultant, an international NGO) and/or the sampling intensity used for the forest inventory.
In the COPAL CF, the development of the SMP has been made possible with the financial support of SNV and the project RICG, which granted 8 millions and 3,5 millions CFAF respectively to the local community.
Local community also contributed substantially during each of the above-mentioned stages. The cash contribution of the local community is about 3,2 millions CFAF.
In addition, the cost of realizing the environmental impact assessment within the CF is about 10 millions CFAF (CARFAD, 2006). For the moment, very few operating CFs have satisfied

this requirement. The reason is that, this measure seems irrelevant in the context of forest usually exploited through low impact methods. The effective implementation of this measure is still subject to debate.

The second group of fixed costs is the one related with the functioning of the CF. Elements of costs include:
- The compilation of annual application files and follow-up (annual operation plan; plot map);
- The renewal of the SMP every five years;
- Functioning costs of the legal entity (office equipment, stationery, prints, general assembly, and wages).

The cost of revising the SMP is based on the experience of a CF in the Eastern province that has recently renewed its SMP (Cuny *et al*, 2006). The costs reported have been estimated at 1000 CFAF/ha.
These costs in the case of COPAL CF have been directly incorporated in the timber exploitation model as costs of access to the resource.

• ***Benefits***
Where the benefits from the creation and functioning of the CF are concerned, the direct benefits stem from the revenues generated by the extractive activities of forest products such as timber, NTFPs, food crops or any project likely to get support from donors.

5.4. Costs and benefits of timber exploitation

• ***Costs***
The costs related to timber exploitation include:
- The **fixed costs** conditioned by the harvesting of timber. These costs occur on an annual basis, and include: the 100%-forest inventory to be carried out on the annual plot of exploitation, the preparation and submission of annual operation plan, along with the pertaining transactions costs (related to the follow-up of application file trough the forest service). This latter is taken into account in the functioning of the legal entity, since it is one of the duty for which the employees of the cooperative receive their wages.
The other costs are **variable costs** related to the running of the small-scale timber enterprise with an engine chainsaw and are proportional to the annual volume of timber harvested. The

workforce mainly relies on local labour. The table 8 summarizes the costs incurred by the small-scale timber exploiters in the COPAL CF.

Table 8: Costs of running a small-scale timber exploitation in COPAL CF

Item	***Cost (CFAF)***		***Observation***
	Softwood	*Hardwood*	
Fixed costs (CFAF per hectare)			
Forest inventory	700		After Vermeulen *et al* (2006)
Variable costs (CFAF per m3)			
Maintenance and repairs	3,900		
Engine chainsaw & depreciation	7,700		Based on a three year depreciation period
Lubricant (oil +fuel)	3,500	3800	Depending on the type of timber (softwood or hardwood)
Labour (chainsaw operator)	6,600	11,500	Depending on the type of wood
Porters	3,900	11,700	
Marketing operation	2,000		Telephone credits, transportation to the market place
Transaction costs	2,000		Informal incentives to gendarmes & forest officers. May be higher in case of activity done informally.
Purchasing of tree	1,250	6,600	This amount is paid out to the owner of the farm, or fallow
Transport	10,000		Transport from the village to Obala
Total	***41,530***	***57,880***	

- ***Benefits***

The benefits of timber exploitation proceed from the sales of timber boards. Planks are sold either at the village level or in some surrounding towns. The location of the market is determined depending on the type of timber marketed. Indeed, high value timber such as Iroko or Pachyloba (subject to strong demand) are more often sold in markets nearby of the CF (Sa'a, Obala), whereas softwood (e.g. Ayous) are sold off in Yaounde. Timber prices per category reported during the survey are summarized in the table 9.

Table 9: Prices of planks reported by key informants in the COPAL CF area

Type of wood	***Example of tree species***	***Price (CFAF/m3)***	***Observation***
Hardwood 1st category	Iroko, Doussie/Pachy, Bete, Bibolo	140,000 100,000	Town market place Roadside (village)
Hardwood 2nd category	Nkanang, Padouk, Tali, Dabema	90,000	
Softwood 1st category	Ayous, Framire, Frake, Ilomba	50,000	
Softwood 2nd category	Eyong, Emien, Aiele	41,000	

5.5. Costs and benefits of NTFP collection

• ***Costs***

Costs of NTFP collection are mainly related to the time spent in collecting a given forest products. The workforce is usually provided by the family. The other costs are represented by the tools used for collection (basin, bucket). The table 10 shows the different costs incurred for the collection of various NTFPs.

Table 10: Costs of NTFP collection in the COPAL CF

Item	***Time spent (man-day)****	***CFAF****
Labour cost	9043	4,521,000
Tools	-	2,158,000
Total		***6,679,000***

* 1 man-day for NTFP collection averages 3 hours

• ***Benefits***

Benefits are derived from the harvesting produce. The figure 2 presents the gross annual receipts obtained from the NTFPs sold in the COPAL CF.

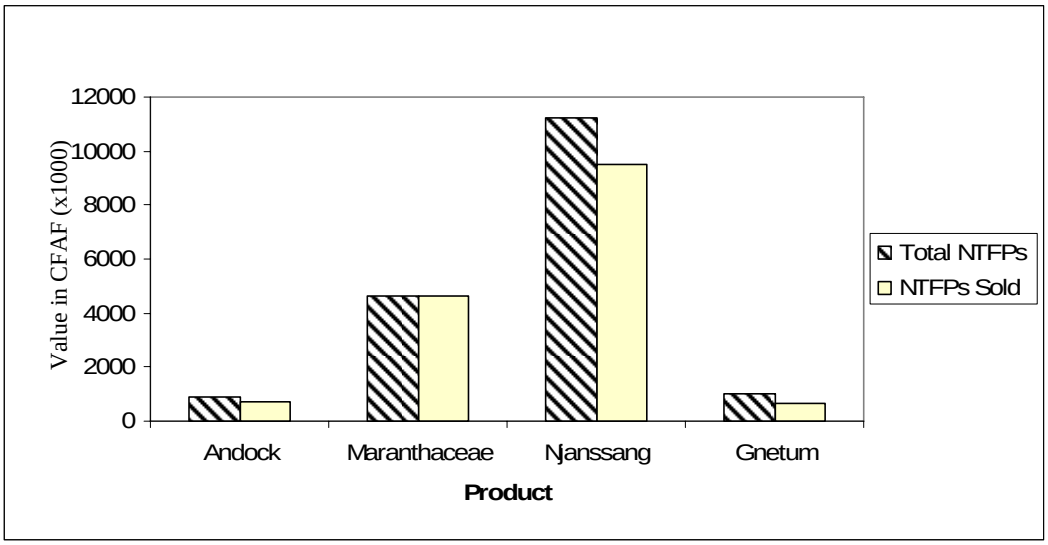


Figure 2 : Value of NTFPs extracted from COPAL CF annually

It is obvious that the real value of the COPAL community forest as related to the overall assortment of NTFPs harvested is more important. However, the figure 2 confirms the fact that Andock, Maranthaceae, Njanssang and Gnetum represent a significant volume of the NTFPs harvested whether it is for commercialization or subsistence purpose.

5.6. Costs and benefits of farming

• ***Costs***

The main costs incurred for the food crop farming are establishment costs and recurring costs. There is a slight difference as one deals with annual or perennial crops. The establishment costs include the costs of seedlings and preparation of the farmland. The bulk of the seed and planting costs are incurred in the initial year when perennials (i.e. banana) are established and the remaining costs are due to replantings each of the subsequent years. On the contrary, annuals such as groundnuts or maize require the purchasing of seeds and the preparation of land each agricultural season.

The recurring costs include: maintenance costs, harvesting costs, transportation costs and material costs such as tools, fertilizers (poorly used in the study site as far as food cropping is concerned). Overall, the common production factor for both categories of costs is the labour.

Information on the average labour costs incurred by households and some other costs for the main cropping systems is presented in the table 11.

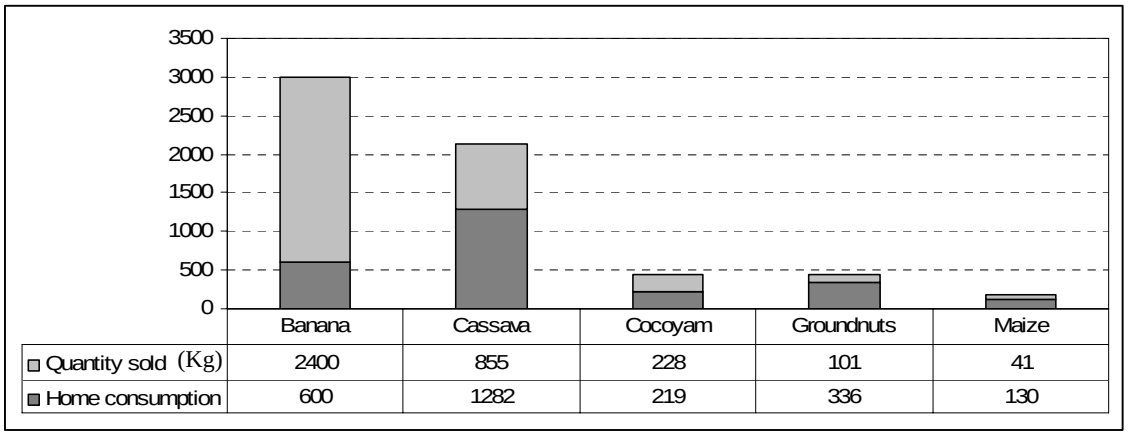
Table 11: Costs of food crop farming in COPAL CF

Crop operation	***Man-day/ha***	***Cost (CFAF/ha)***
Groundnuts-based system		
Clearing and burning	30	30,000
Tillage and planting (groundnut, maize)	33	33,000
Collect cassava stick	2	1500
Planting Cassava	7	7000
Weeding	26	25,900
Harvest		
Groundnut + Maize	44	44,000
Cassava	31	31,000
Field transport	12	6000
Plantains – cocoyams-based system		
Fell trees	2	3000
Clear field + burning	28	28,000
Harvest plantain suckers and cocoyam corms	6	4500
Hole digging	6	6000
Transport and planting	6	3000
Weeding	14	14,000
Harvest		
Banana (plantain+sweet banana)	16	16,000
Cocoyam	24	24,000
Field transport	6	3000
Establishment costs (seedling)		
Groundnuts		5000
Maize		1000
Tools		13,143
Total costs		***299,000***

• ***Benefits***

The benefits are derived from the crops harvested. A part of the agricultural production is consumed at the household level, while the surplus is marketed. This particularly applies to crops such as groundnuts, cassava, or maize of which a larger proportion is consumed.

The figure 3 shows the annual production per ha for the main food crops grown in the COPAL CF.



	Banana	Cassava	Cocoyam	Groundnuts	Maize
Quantity sold (Kg)	2400	855	228	101	41
Home consumption	600	1282	219	336	130

Figure 3: Annual production per ha, marketed surplus, and home consumption in COPAL CF

Banana (plantain/sweet banana) represents one of the most sold crops in the study area. Its cultivation may however have an incidence on the state of the forest, as it considered producing good yield in forest land, while contributing to the livelihood of rural people. Therefore give an impetus to farmers to growing crops within the forest.

6. Costs and benefits of BB CF scenarios

6.1. BB CF history

The Mount Cameroon Project (MCP) has had a key role in the establishing of the BB CF. In 1996, MCP identified and began working with some existing local forest management institutions set up by the chiefs and native people who were becoming concerned about the alarming rate of forest destruction. The institutions were the Victoria Lands and Forest conservation Committee (VLFCC) and the Victoria Area Rainforest Common Initiative Group (VARCIG). In 1998 all discussions and negotiations between MCP and other stakeholders of the area led to the formation of the Bimbia Bonadikombo Natural Resource

Management Council (BBNRMC) and a land use plan was agreed. BBNRMC worked closely with MCP and the local forestry service and together with all stakeholders of the area agreed to a Community Forest as the legal option for the management of the forest. The management plan was written, submitted and approved by MINEF in March 2002. Actual management of the community forest started in august 2002, with BBNRMC as the legal entity. Since the signature of the management agreement, the main difficulties have been linked to the complex nature of the area and the fact that there is no real community, people live scattered all over the area (Fawoh, 2002). Some important characteristics of the SMP are furnished in the table 12.

Table 12: Main features of the BB CF SMP

Features	***Description***
Community forest area	3735ha
Duration of the agreement	25 years
Phase	Review process of the SMP
Land use plan	Core forest (979 ha), Mangrove (250 ha); Farms and area of extractive activities (2500 ha)
Compartment (09)	Liwanda (286 ha); Bamukong (741ha); Moliwe hills (565 ha); Bonadikombo (400 ha); Mawoh (229 ha); Bimbia (229 ha); Dikolo peninsular (250 ha); Likomba la lelu & la mbenge (979ha).
Priority uses	Conservation of the area's rich biodiversity; Ecotourism; Sustainable exploitation of charcoal, fuelwood, timber, NTFPs and wildlife; sustainable agriculture, reforestation of degraded areas, protection of water catchment, bee farming

6.2. BB CF scenarios

As mentioned earlier the BB CF came to existence as a result of the efforts of some conservation NGOs (Limbe Botanic Garden and Rainforest Genetic Conservation) that wanted to establish a reserve in this area. Establishing a CF was later on found to be the best way to pursue conservation objectives, where the purely technocratic approaches (with little regard to social aspects) had failed. The BB CF has inherited this conservation legacy.

Activities checked-off in the SMP are mainly directed towards a management of the forest resources aiming to fulfill this objective and include:

- Timber exploitation;
- Commercial exploitation of charcoal;

- Commercial exploitation of firewood;
- Sustainable agriculture;
- Ecotourism and research.

Some other activities such as NTFP collection, reforestation of degraded areas, protection of water catchment, or bee farming have not been included either because they are undertaken for subsistence purpose or still in a very embryonic stage (thus providing few exploitable data).

Furthermore, some forest services have been identified as relevant for the analysis, since they may be partly associated to the protection of the forest namely, fishing-ground protection, and carbon sequestration.

Similarly with the case of COPAL, three scenarios have been identified:
- Scenario 1: 'Strict implementation of the SMP' with a highly oriented conservation goal;
- Scenario 2: Situation 'without CF'. In this case, it can also be thought that the forest is withdrawn;
- Scenario 3: 'Adjusted implementation of the SMP'.

6.2.1. Timber exploitation

Timber exploitation is performed by some local operators who usually use an engine chainsaw to produce boards. In contrast to COPAL CF, where the legal entity intends to harvest the forest by itself, the BBNRMC grants permits to local timber exploiters most coming from the surroundings of Limbe. The SMP stipulates clearly that all extractive activities should be carried out according to the setting of pre-determined quotas. But, the reality is that no forest inventory has been carried out since 1998, so that majority of extractive activities is being undertaken without a clear knowledge on the actual state of the forest resource.

Scenario 1: Strict implementation of the SMP

Under this scenario, extraction of timber is defined to an area of 2506ha, since a portion of the forest has been put aside for conservation purpose.

Harvesting is being done according to the sustainable annual harvesting determined based on

the available forest inventory data. That is 1,12 m3/ha for hardwood and 5,50 m3/ha for softwood harvested at a constant rate during the life of the project. The following figures suggest that for a given area of forest, the plot to be exploited is determined according to the rotation cycle (25 years).

Scenario 2: No community forest

In this scenario, timber harvesting is being undertaken over the whole area dedicated to the community forest i.e. 3735 ha. This situation actually corresponds to that of a forest under the control of the forestry administration (MINFOF), often characterized by a lack of logistical means to perform appropriate control. Again, the rotation cycle (25 years) is used to determine the potential annual volume harvestable. Contrary to the previous scenario, operators focused primarily on hardwood that yields better prices on the local market.

Accordingly, 80% of the annual harvesting rate is hardwood, while the remaining 20% is softwood. The stock of hardwood harvested at this rhythm is completely depleted after some years, at that given point the stock of softwood increases by 50% each five year period.

The increase in the harvesting of softwood over the time might be supported by the current tendency towards harvesting of second quality timber. It is predictable that with increase scarcity of hardwood, timber exploiters have more and more resort to softwood timber.

Scenario 3: Adjusted implementation of the SMP

The area under exploitation is 2506 ha. There is a slight difference with the first scenario in which harvesting rates are constant for both timber categories. Here, it is assumed that small-scale timber operators place a great focus on hardwood.

Accordingly, 65% of the annual harvesting rate is constituted of hardwood and 35% of softwood. When the stock of hardwood depletes completely after a certain number of years, the annual harvesting rate of softwood will increase by 30% and so on every five year-period.

The table 13 provides a summary of the main hypotheses used for the different scenarios.

Table 13: Timber harvesting hypotheses for the different scenarios in BB CF

	Area of exploitation	***Evolution of annual harvesting rate over a 25 year cycle***	
		Hardwood	*Softwood*
Scenario 1	2506 ha	Constant (+17%)	Constant (+83%)
Scenario 2	3735 ha	+ 80% until HW= 0	+20%; When HW= 0, +50% each subsequent 5 years
Scenario 3	2506 ha	+65% until HW= 0	+35%; When HW=0, +30% each subsequent 5 years

6.2. 2. Commercial exploitation of charcoal and firewood

Interviews conducted with charcoal burners show that *Lophira alata* known as ironwood is the tree species mostly used for charcoal production. The density of its wood is thought of to favour better heat and therefore provide good charcoal. Other tree species belonging to Irvingiaceae family - such as *Desbordesia glaucescens, Irvingia Spp, Klainodoxa gabonensis* commonly called in the study area under the generic term of Mangowood - are not largely used for that purpose. This preference for *Lophira alata* has been further confirmed by permit records. Of the 42 permits issued in 2006, about 99% are made of ironwood. In contrast, firewood collectors show their preference to mangowood trees. In reality, though the market price of ironwood-based firewood remains relatively high as compared to other timber, exploiters need to travel long distances throughout the forest to collect them, with the direct consequence of increasing the head transportation costs and slowing down the work pace. Further on, (less heavy) mangowood logs can be carried over reasonable distances. Unanimously, the key informants encountered acknowledge distances greater than 3km, to be physically tiring for porters, therefore making the business unprofitable. Firewood collectors have reported to increasingly harvest small size trees (DBH≥ 50cm), exception being of ironwood harvested at 60 cm DBH. This tendency towards cutting small diameter might be explained by the fact that majority of big size trees are located far into the forest, making the small diameter more accessible. This information is taken into account in the determination of the harvestable volume.

Both charcoal production and firewood collection activities share on the same resource, since species potentially harvestable include ironwood and mangowood.

Scenario 1: Strict implementation of the SMP

Harvesting rate hypotheses are set up according to a more sustainable harvesting of trees. The number of permits delivered on an annual basis decreases by 30% as a direct consequence of fostering of more sustainable quotas, i.e. 31 and 38 trees respectively for charcoal and firewood production. Furthermore, the MDE is raised to 60cm for the tree species. This entails a reduction of the number of harvestable trees of about 30% compared to the scenario 2 and 3.

- *Basic hypothesis:*

65% of harvestable mangowood stems are exploited by charcoal burners as the permits pertaining to this activity yield more income to the legal entity compared to firewood collection that will then extract 35% of the stock.

- *Charcoal*

Acknowledging the new steps taken by the legal entity (BBNRMC), which has recently decided to suspend harvesting of ironwood, until a forest inventory provides an accurate picture of the existing stock of various commercial trees. Harvesting is therefore basically concentrated on mangowood stems.

A steady number of mangowood stems is harvested over the life of the project.

- *Firewood*

In the first five years 60% (23 trees) of annual stems harvested consists of mangowood; and 40% of Okak (15 trees). However, as a consequence of increasing distance over the time, it is assumed that 15% of the stems of mangowood harvested *per annum* decreases every five years, and the missing stems are therefore replaced for the same amount by Okak up to the end of the rotation.

Scenario 2: without community forest

- *Basic hypothesis*

It is assumed that 85% of ironwood stems available (with DBH>= 60cm) are used for charcoal and 15% for firewood collection.

-*Charcoal:*

In this scenario the number of stems harvested and bags produced on a yearly basis increases by twice. This is thought of to be a reasonable prospect, bearing in mind that what actually prevents harvesting intensity to increase drastically is the patrolling activities.

The number of trees felled p.a. amounts 88.

When the stems of ironwood have completely been depleted they are replaced by the same amount of mangowood stems, so that the annual harvestable number of trees under this scenario (88 trees) is always attained.

- *Firewood collectors*

The number of trees harvested increases by twice.

70% of trees harvested annually are mangowood (62 trees), 25% ironwood (23) and 5% Okak (5 trees).

The available stock of ironwood harvested depletes fast, and is replaced correspondingly by mangowood stems to reach the average annual production of 90 trees.

After the first five years, it is assumed that the annual amount of mangowood stems harvested decreases by 20% each five year. The missing stems of mangowood are replaced by Okak stems more available. It can be effectively argued that since mangowood stems are disputed by the two categories of user groups, their accessibility diminishes over economically profitable distances. The tendency will therefore be for firewood collectors to reduce their harvests of mangowood, substituting it with Okak readily harvestable.

Scenario 3: Adjusted implementation of the SMP

This scenario actually corresponds to the current situation where the SMP is supposed to be implemented according to predetermined quota. However, there is no solid basis to set sustainable quotas. The area covered is 2506 ha, excluding the core zone reserved for conservation purpose.

- *Basic hypothesis*

It is assumed that 85% of ironwood stems available (with DBH>= 60cm) are used for charcoal and 15% for firewood collection.

- *Charcoal*

Evolution of timber stock is based on a principle of substitution. That is to say, charcoal burners exploit all the stems of ironwood until they deplete completely. At this given point, mangowood stems are harvested to substitute the missing stems of ironwood so that annual production of charcoal (44 trees) is still maintained.

- *Firewood*

From the annual production (54 trees/year), 50% of the stems harvested are mangowood, 25% ironwood and 25% Okak.

Again, the stock of ironwood available will deplete rapidly. Therefore, the missing stems are substituted by mangowood stems at a rate equal to the diminishing amount of ironwood stems. The stems of Okak collected remain constant over the rotation period, since the stock of mangowood does not run short.

A summary of the main hypotheses of the charcoal and firewood models are provided in the table 14.

Table 14: Charcoal and firewood harvesting hypotheses for the different scenarios in BB CF

	Distribution of stems between charcoal & firewood	***Evolution of the number of stems harvested annually per type of timber species***		
		Ironwood (Ir)	*Mangowood (Ma)*	*Okak (Ok)*
Charcoal				
Scenario 1	65% total stock of mangowood	Prohibited	Constant (31)	-
Scenario 2	85% total stock of ironwood	100% of stems (88) until stock *Ir* =0	0 stems before; when *Ir* =0,100% of stems *Ma* (88)	-
Scenario 3	idem	100% of stems (44) until stock *Ir* = 0	0 stem before; when *Ir* = 0, 100% stems *Ma* (44)	-
Firewood				
Scenario 1	35% total stock of mangowood	Prohibited	60% in the first 5 years; -15% each subsequent 5 years	40% in the first 5 years; +15% each subsequent 5 years
Scenario 2	15% total stock of ironwood	25% of stems until *Ir* = 0	70% of stems before; when *Ir* = 0, -20% every 5 years	5% of stems; when *Ir*= 0, then +20% each 5 years
Scenario 3	idem	25% of stems until stock *Ir*=0	50% before; when *Ir* = 0, +25%	25% of stems; constant

6.2.3. Farming activities

The analysis of farming activities is mainly focused on food crop agriculture locally known as “chopfarming”. Indeed, it is predictable that this agricultural system will increasingly be implemented in this area over the time, as a response to food security issues related to the high demography of Limbe town and its surroundings. Furthermore, the farm survey performed during this research indicates that very few farmers (6,7%) are involved in cash crop-based farming.

The main crops of the farming system are those commonly found in it, namely cassava, cocoyam, maize, plantain/banana and some leafy vegetables. Though, useful trees are common components of this system, the first reason for opening the forest or a new field is to grow food crop whether it be for commercial or subsistence purpose. These crops are grown following a mixed cropping pattern (87,3% of farmers). A general trend in the BB CF is the quasi-absence of fallow period.

Scenario 1: Strict implementation of the SMP

In this scenario, it is expected that sensitization efforts undertaken by the legal entity, aiming to encourage farmers to adopt better agricultural practices such as agroforestry yield positive

results. The variables across the different scenarios concern the area change and the annual decline in fertility that affect the yield expected. Oji *et al* (1998) have estimated the rate of farming expansion in this area at 60 ha *per annum*.

The annual farm expansion rate decreases by half (30ha/year) and is limited to the non-protected area. The decline in fertility that characterizes the region is taking into account in applying an annual decrease of 0,5% on the crop yield.

Scenario 2: No community forest

In this scenario, it is considered that in a 'free open access' land the pace of farm expansion within the forest will increase. Thereby, the rate of 60 ha/year is incremented by an additional 40 ha to include this fact. The annual yield decline is assumed to be 2% *per annum*. This decline in fertility is among other things caused by the shortening of fallow period in the area.

Scenario 3: Adjusted implementation of the SMP

The main difference with the scenario 2 above is related to the annual change in area that is estimated at 60 ha/year.

A summary of farming activities for the different scenarios is presented in the table 15.

Table 15: Farming hypotheses for the different scenarios in BB CF

	Evolution of new farm area and yield change annually	
	Annual yield change	*Area change* (ha)
Scenario 1	-0,5%	-50% (30ha/year)
Scenario 2	-1%	+60% (100ha/year)
Scenario 3	-1%	Current (60ha/year)

6.2.4. Ecotourism and research

Nature tourism is one among very few management alternatives that actually seek to preserve the forests in their natural state, and at the same time gives the country important revenues in foreign currencies and provide employment for local labour (Shreckenberg and Hadley, 1991). The BBNRMC has laid a particular interest on ecotourism and research to generate incomes that might allow them to support their conservation goal. Since the onset of the CF, these activities have not yet attained the expected results. Some factors may have hindered a soaring of this activity namely:

- the bad state of the road from Limbe to the tour site;
- Insufficient advertisement on the existence of the visit tours;

- The relatively low entrance fees charged to the visitors;
- Lack of adequate reception facilities within the site.

Many endeavours are currently undertaken by the BBNRMC to advertise their forest, such as the creation of a webpage, the establishing of partnerships with some universities in Canada, pursuing of the distribution of BB CF brochures in hotels, travel agencies and the like.
Furthermore, Bimbia has recently been established as a subdivision, so that it is likely that road infrastructure will be levelled. An increase of the number of visitors can therefore be anticipated for the year to come if those actions are maintained.

The BB CF has registered an average of 45 visitors per year of different nationalities. This activity is assumed to be the same for the scenario 1 and 3.

6.3. Costs and benefits of creation and implementation of the CF

• ***Costs***

The costs of creation of the BB CF are composed of similar element of costs as seen earlier for the creation of the COPAL CF. The MCP-Limbe project has financially supported the various stages inherent to the creation of the forest. Due to the lack of accurate financial records on the total investment incurred by MCP during the process, the value of 14,000,000 CFAF (Njebet *et al,* 2000) has been used to account for this cost.
The costs of the revision of the SMP are based on the similar values as in the COPAL CF taken from Cuny *et al* (2006).

The costs of implementation of BB CF are those related to the functioning of the legal entity. In effect, a number of costs are incurred by the BBNRMC to get the business run. These costs include the wages, transportation costs, stationery and office equipment, advertisement. They are adapted from the financial record of the BB CF annual activity report. The table 16 presents the main cost associated with the creation and the functioning of CF.

Table 16: Main costs for the creation and functioning of the CF

Item	***Cost (CFAF)***	***Remarks***
Creation of the CF	14,000,000	Entirely supported by the MCP project (as a grant)
Renewal of the SMP (after 5 years)	3,735,000	
Functioning of the CF (per year)		
Overhead	2,000,000	Wages of full workers, debts, etc.
Printing, advertisement, sensitization etc.	800,000	
Transport	1,200,000	
Volunteer wages (operation committee members)	1,800,000	Allowances for successful patrol + monthly instalment
Subtotal functioning costs	5,800,000	
Total	***10,935,000***	

Further the costs of creation of the CF that occur as subsidies to the community are incorporated in the timber model, while the functioning costs of the CF are calculated for the BBNRMC and referred as management costs.

- ***Benefits***

The benefits are mainly derived from the sales of permits and the ecotourism and research activities. Grants may also be provided to the legal entity by various donors and depending on the fund raising strategy of the structure. This benefit may represent a rather big proportion of the total income that accrues to the BBNRMC. However - due to the uncertainty that rests on the amount of funds likely to be granted to a legal entity - the analysis rather focused on the direct revenues the local community may earn from the implementation of the SMP activities.

The value of permits sold, along with the average number of permits delivered based on the pre-financial records from the year 2005 and 2006 are presented in the table 17.

Table 17: Value and average number of permits granted in BB CF

Activity	***Average number of permits sold per annum***	***Value (CFAF)***
Timber exploitation	44	1,600,000
Charcoal burning	44	2,200,000
Firewood collection	06	2,10,000
Ecotourism & research	45 visitors	337,500
Fines & seizures	-	1,332,000
Total		***5,679,500***

6.4. Costs and benefits of timber exploitation

- ***Costs***

The costs of timber exploitation are relevant with those incurred by the local operators contracting with the legal entity. Overall, the centres of costs are similar to that of the COPAL CF. The main costs related to timber exploitation are presented in the table 18.

Table 18: Costs of timber exploitation in BB CF

Item	***Cost (CFAF)***		***Observation***
	Softwood	***Hardwood***	
Inspection fee	4,780		Benefit to the legal entity
Permit	5,980	8,370	
Maintenance and repairs	4,410		
Engine chainsaw & depreciation	3,775		Based on a three year depreciation period
Lubricant (oil +fuel)	3,950		
Labour (chainsaw operator)	9,750	13,000	Depending on the type of timber (softwood or hardwood)
Assistant (helper)	1,930		
Porters	13,000	16,250	
Marketing operation	290		Telephone credits, transportation to the market place
Transaction costs	1110		Informal incentives to gendarmes & forest officers. May be higher in case of activity done informally.
Transport	2,600		From the BB CF to Limbe town
Total	***51,575***	***60,460***	

- ***Benefits***

The benefits proceed from the selling of timber in the local market or to private individuals. The quantity of timber harvested varies across the management regimes (scenarios) concerned. The prices of timber practiced in the study sites for different categories of timber are presented in the table 19.

Table 19: Prices of timber in the BB CF area

Type of wood	***Some tree species harvested***	***Price (CFAF/m3)***	***Observation***
Hardwood	Padouk (camwood); Dabema (small leaf); Niove (Bobie); Bilinga (opepe)	99,000	1/12 board =3000 CFAF, and 1m3=33 pieces
Softwood	Frake, Emien (milk stick), Ekoune (man carabod); Ilomba (woman carabod)	66,000	Idem. 1/12 board = 2000 CFAF

6.5. Costs and benefits of charcoal and firewood

• ***Costs***

The costs incurred by charcoal burners and firewood collectors are quite similar each other. They usually include: the renting of the chainsaw, the felling of the tree and its cross-cutting, the splitting of the logs into pieces and the head transportation of charcoal bags or firewood pieces up to the point of transportation. Some costs are however specific to charcoal burning, these are: pit digging, fetching of water and packing of the charcoal, and some small material such bags, ropes etc. It is worth to mention that, in order to cut down production costs, some of these tasks are personally performed by charcoal burners.

Fixed costs are those related to the purchasing of permits. The main costs incurred for charcoal and firewood production are listed in the table 20.

Table 20: Production costs for charcoal and firewood in the BB CF

Item	***Price***	***Observation***
Charcoal production (CFAF/ bag)		
Inspection fees	195	
Permit	675	
Felling	60	
Cross-cutting	1000	
Fuel+oil	750	
Splitting	300	Often personally done by charcoal burner
Pit digging	40	idem
Packing + burning	500	idem
Removal of charcoal (water fetching)	1000	
Transport from forest to home	1000	
Transport to market	300	(Taxi or motorbike fare)
Other charges		
Council taxes	135	
Bags, robe,cover	25	
Axe	10	
Feeding	165	
Total cost production charcoal	***6,150***	
Firewood production (CFAF/bole)		
Rentage of engine chainsaw	17,500	
Felling	3250	
Cross-cutting	10,500	
Splitting	17,500	Personally done by the operator
Lubricant (oil+fuel)	10,930	
Head transportation (Bambe)	31,500	
Vehicle transportation	49,000	
Transaction costs	7000	
Other charges	330	
Total cost production firewood (CFAF/bole)	***147,500***	

• ***Benefits***

Benefits are derived from the selling of charcoal bags and log pieces in the local market. Prices vary depending on the climatic season. Very often, prices offered during the rainy season are usually higher for the two types of products. The table 21 presents the average price used for the calculation of benefits for the two types of products.

Table 21: Price of charcoal bag and firewood bole in BB CF

Type of products	***Price (CFAF/per bag or bole)***	***Observation***
Charcoal	7,500	Ironwood-based product
Firewood		
Ironwood	189,000	
Mangowood	168,000	
Okak	157,500	

6.6. Costs and benefits of farming

• ***Costs***

In a similar way, the structure of costs of farming activities in BB CF is same as in the COPAL CF. The table 22 summarizes the main item of costs about food cropping in the BB CF.

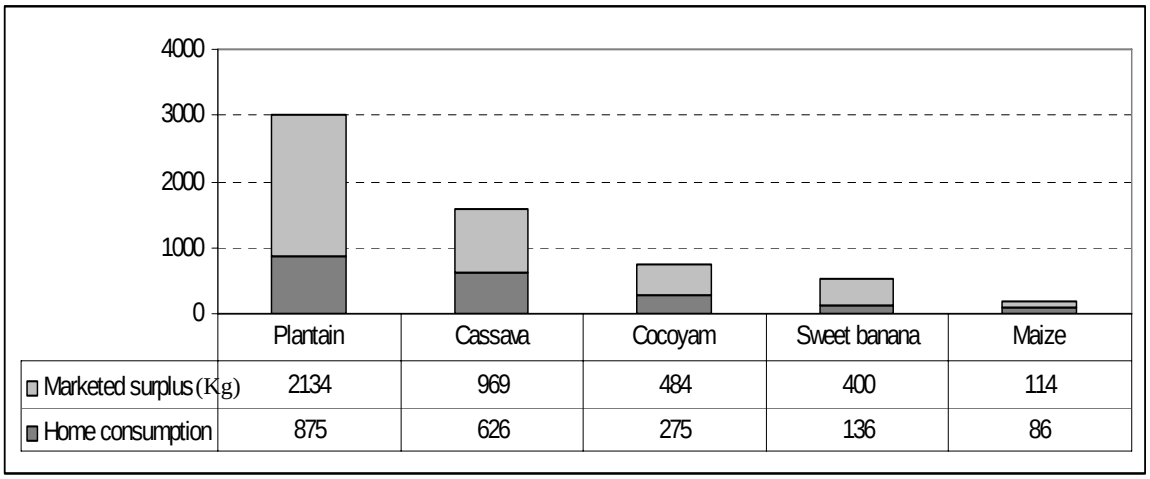
Table 22: Costs of food crop farming in the BB CF

Crop operation	***Man-day/ha***	***Cost (CFAF/ha)***
Land preparation (clearing, destumping)	33	49,500
Tillage, or ploughing	40	40,000
Hole digging	18	15,300
Collect plantain,banana (harvest suckers)	20	10,000
Collect cocoyam (harvest corms)	5	2,500
Collect Cassava (harvest sticks)	6	3,000
Planting different crops	27	13,500
Weeding	24	24,000
Harvesting	81	81,000
Transportation from farm	35	35,000
Seed purchasing*		
Plantain, Banana		25,000
Maize		2,740
Cocoyam		2,500
Tool		3,085
Total		***307,135***

* Purchasing of banana suckers and cocoyam occurs only in the initial year of the farm creation

• ***Benefits***

The proceeds of food crop farming are obtained from the selling of harvesting surplus. While, a part of crops harvested contribute to the food security of the household. The figure 4 shows the yield per ha for the main food crops grown in the BB CF.



	Plantain	Cassava	Cocoyam	Sweet banana	Maize
Marketed surplus (Kg)	2134	969	484	400	114
Home consumption	875	626	275	136	86

Figure 4: Annual production per ha, marketed surplus and home consumption in the BB CF

6.7. Costs and benefits of ecotourism and research

• ***Costs***

The costs related to ecotourism in BB CF consist to the maintenance of the trekking trail, the preparation of camping site, and the marketing of the ecotourism experience through various means of advertisement (Web page, booklet and prospectus distribution in hotels, participation to workshop and seminars etc.). These costs are an integral part of the general costs relevant to the functioning of the CF (legal entity), earlier mentioned.

• ***Benefits***

Income from ecotourism activities are obtained from tourists and researchers interested to discover the mangrove or the protected zone of the forest. The table 23 reports the number of visitors and the revenues generated in the year 2005 and 2006.

Table 23: Income generated from ecotourism and research activities in the BB CF

Year	***Purpose of visit***	***Number of visitors***	***Income (CFAF)***
2005	Tourism	45	417,000
2005	Research	3	150,000
2006	Tourism	38	248,500
2006	Research	4	115,000

Source: Financial records from BB CF annual reports 2005 and 2006

7. Results and discussion

7.1. CBA results of COPAL CF

7.1.1. Timber exploitation

Stream of returns over the project life

The figure 5 presents the net cash flows obtained from timber exploitation in the COPAL CF by subtracting the yearly costs from the yearly returns for the different scenarios over the life of the project.

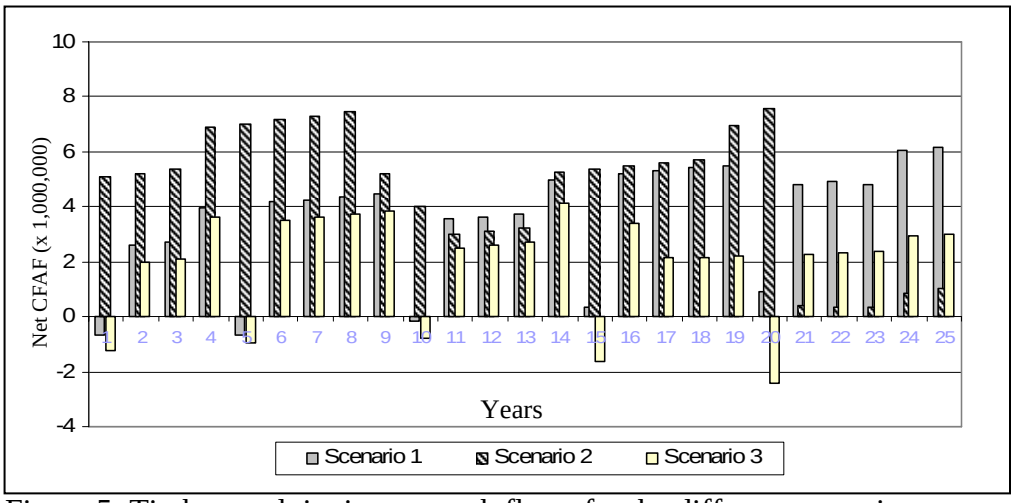


Figure 5: Timber exploitation net cash flows for the different scenarios over a 25- year cycle in the COPAL CF

In the 'business-as-usual' situation (scenario 2), the net revenues are relatively high compared to the scenarios 'strict' or 'adjusted' implementation of the SMP up to the year 20. The sharp decrease of the net returns observed from the year 20 on, points up the unsustainable character of this harvesting regime. Indeed, if current harvesting rates upon highly commercial species are maintained, then the scenario 2 will probably be the more unprofitable for the next cycles.

Results

The streams of annualized net benefits from timber harvesting have been discounted for each of the alternatives under analysis. The results of the economic and financial analysis are summarized in the table 24.

Table 24: Timber production: discounted net returns per ha over a 25-year cycle in the COPAL CF

Scenario	***Financial NPV @5% CFAF/ha***	***Economic NPV @5% CFAF/ha***
Scenario 1	11,987	17,490
Scenario 2	18,703	25,123
Scenario 3	7,242	12,055

Interestingly is that the net returns per ha stemming from the strict implementation of the SMP are higher than that of the alternative consisting to focus on first category hardwood in the beginning of the process. The alternatives 'without community forest' remain more attractive, as it applies to a case of 'free open access to the resource' in which local operators depending on the demand of the market, may cut down trees under the MDE. However, as pointed out earlier, in the long term (say another rotation), it can be anticipated that the forest will lose its economic value as related to timber exploitation. While, in the case of strict implementation of the SMP, timber exploitation on the basis of sustained harvesting rates may still continue for the next cycles.

Sensitivity analysis

The scenario 1 which refers to the strict implementation of the SMP is considered to be the base case. Certain parameters of the timber exploitation model are varied to assess how unexpected costs or yields will affect the outcome of the analysis.

The financial and economic analysis of timber exploitation in COPAL CF according to the 'strict implementation of the SMP' and the 'the without CF' were done following three assumptions:

- Operating costs of the small-scale timber enterprise are higher than expected by 10%;
- Returns are lower than expected by 10%;
- Annual harvestable timber is lower than expected by 10%.

The table 25 presents the results of the sensitivity analysis for the assumptions above-mentioned, following various discount rates.

Table 25: Sensitivity analysis of timber exploitation net benefits from scenario 1 (denoted Strict SMP) under alternative assumptions in the COPAL CF

Assumptions	***Unit (CFAF/ha)***	*Base case (at 5%)*		*3%*	*8%*	*12%*	*35%*
		Strict SMP	*No CF*				
10% decrease of timber price	*Financial (NPV/ha)*	11,987	18,703	10,538	5,540	3,604	706
	Economic (NPV/ha)	17,490	25,123	17,989	9,064	5,529	128
10% decrease of annual harvestable stock	*Financial (NPV/ha)*	11,987	18,703	11,440	6,167	11,987	945
	Economic (NPV/ha)	17,490	25,123	16,892	8,473	5,138	44
10% increase of costs	*Financial (NPV/ha)*	11,987	18,703	12,169	11,987	4,253	11,987
	Economic (NPV/ha)	17,490	25,123	20,659	17,490	6,641	17,490

The sensitivity analysis reveals that even if expected timber costs increase by 10%, at a discount rate of 8% the NPV of the strict implementation of the SMP (scenario 1) is still quite high compared to that of the scenario 3 (~ 7,240 CFAF/ha).

7.1.2. NTFP collection

Stream of returns over the project life

The figure 6 shows the net cash flows for the different scenarios obtained from NTFP collection in COPAL CF. It appears that even if the returns from the adjusted implementation of the SMP regime (scenario 3) are quite important within the first years of the project, the 'strict implementation of the SMP' scenario displays a more steady stream of annual returns over the life of the project.

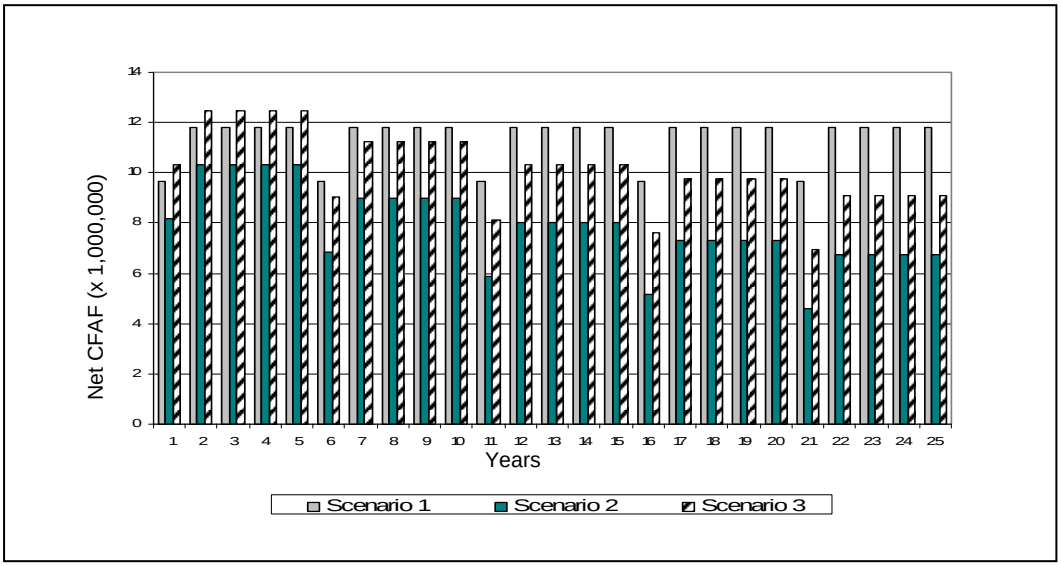


Figure 6: NTFP collection net cash flow for the different scenarios over a 25- year cycle in the COPAL CF

Results

The results of the financial and economic analysis are presented in the table 26 below:

Table 26 : NTFP collection: discounted net economic returns per ha over a 25 year cycle in COPAL

Scenario	***Financial NPV @5% CFAF/ha***	***Economic NPV @5% CFAF/ha***
Scenario 1	41,610	48,605
Scenario 2	30,246	38,009
Scenario 3	38,516	82,792

There is a wide range of NTFP values ranging between $1.22 per ha/year to $350 per ha/year (IIED, 2003). The returns per hectare of the financial analysis obtained in this study ($84/ha) represent an average value of this range.

All the scenarios display a positive NPV, as it is often the case when valuing NTFPs.
The scenario 1 which refers to a decrease by 20% of the prevailing level of harvest, yields the highest NPV (CFAF/ha) compared to other alternatives in financial terms. This result may be an impetus for the local community to implement sustainable harvesting of NTFPs, mostly if a relative price increase is induced as a result of group selling. It is important to keep in mind that the price increase assumed for the purpose of analysis is rather conservative compared to that of some on-going experiences.

Sensitivity analysis

The assumptions tested against the base case in the sensitivity analysis are presented as follows:

- The annual quantity of NTFPs harvested is lower than expected by 10%;
- The labour intensity for NTFP collection is higher than expected by 10% (e.g. due to increasing scarcity of certain NTFPs);
- The returns from NTFP collection are lower than expected by 10%.

Similarly with timber exploitation, different discount rates are applied along with these assumptions to assess their effect on the final outcome.

The table 27 presents the results of the sensitivity analysis of NTFP collection following the assumptions above-mentioned.

Table 27: Sensitivity analysis of NTFP collection net benefits (CFAF/ha) from scenario 1 under alternative assumptions in COPAL CF

Assumptions	***Unit (CFAF/ha)***	*Base case (5%)*		*3%*	*8%*	*12%*	*35%*
		Strict SMP	*No CF*				
10% decrease of returns	*Financial (NPV/ha)*	41,610	30,246	44,081	26,904	19,698	7,034
	Economic (NPV/ha)	48,605	38,009	51,875	31,657	23,174	8,268
10% decrease of annual quantity harvested	*Financial (NPV/ha)*	41,610	30,246	44,081	26,904	19,698	7,034
	Economic (NPV/ha)	48,605	38,009	51,875	31,657	23,174	8,268
10% increase of labour intensity of NTFPs	*Financial (NPV/ha)*	41,610	30,246	49,438	30,187	22,110	7,912
	Economic (NPV/ha)	48,605	38,009	58,097	35,468	25,972	9,283

Overall, even with the higher discount rate (35%) that actually represents the rate farmers are willing to use for decision-taking, the results of the NPV remain positive for the base case. Interestingly, if the annual returns or the yields are to decrease by 10% the scenario 1 is still the best in financial terms compared to the others alternatives (at 3% discount rate).

7.1.3. Farming

Stream of returns over the project life

The figure 7 shows the net cash flow for the different scenarios obtained from farming activities in the COPAL CF. During the first five years high returns are generated for all the scenarios. This is due to an increase of the farmland size during the period of construction of the Nachtigal dam. Thereafter, the stream of returns undergoes a steady decrease. This may be imputed to the hypothesized decline of productivity combined with a little annual increase of the farmland size, occurring after the dam project. It is important to keep in mind that, the cash flow is greatly influenced by the incorporation of the opportunity cost of time of labour in its calculation (most labour is often provided by the family or labour exchange group).

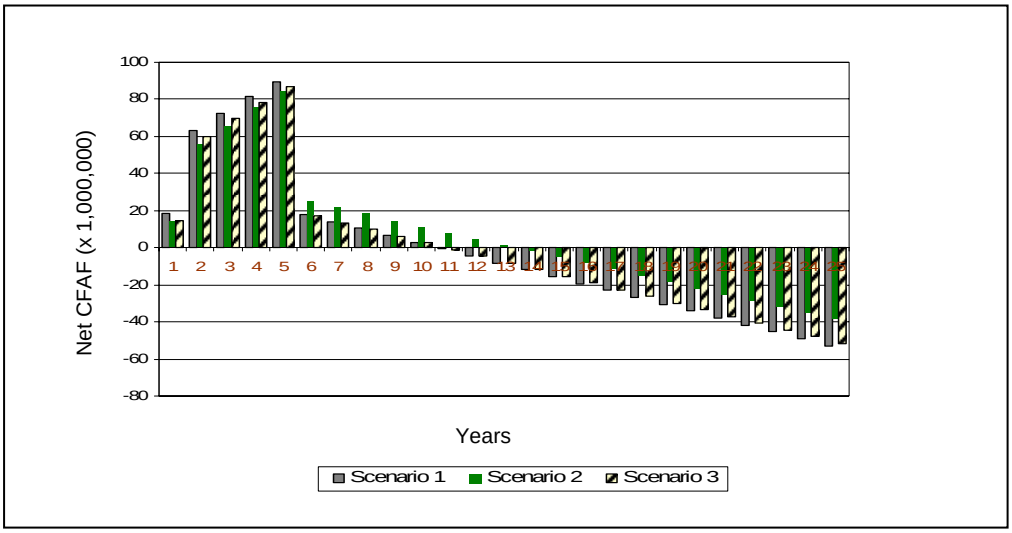


Figure 7: Cash flow of farming activities in the COPAL CF over a 25 year- cycle

Results

The table 28 shows the summary of the NPVs obtained in the different scenarios.

Table 28: Farming values: discounted net economic returns per hectare over a 25-years cycle in COPAL CF

Scenario	***Financial NPV @5% CFAF/ha***	***Economic NPV @5% CFAF/ha***
Scenario 1	33,806	641,816
Scenario 2	48,964	584,257
Scenario 3	31,009	608,668

The returns per ha for the different management regimes are all positive, with the strict implementation of the SMP yielding the highest economic returns compared to the other scenarios. This might be explained by the fact that the total production considered for the economic analysis includes both home consumption and marketed surplus. Therefore from the perspective of the community as a whole, the strict implementation of the SMP generates the best returns on a per hectare basis.

Sensitivity analysis

The assumptions against which the base case has been tested are as follows:

- Yields are lower than expected by 10%;
- Returns are lower than expected by 10%;
- Labour intensity is higher than expected by 10%.

Following the same procedure as earlier, different discount rates are applied along with the above-mentioned assumptions. The table 29 presents the results of the sensitivity analysis.

Table 29: Sensitivity analysis of farming activities in COPAL CF under alternative assumptions

Assumptions	***Unit (CFAF/ha)***	*Base case (5%)*		*3%*	*8%*	*12%*	*35%*
		Strict SMP	*No CF*				
10% decrease of returns	*Financial (NPV/ha)*	33,806	48,964	-57,939	-8,879	-	-
	Economic (NPV/ha)	641,816	584,257	638,879	387,843	-	-
10% decrease of yields	*Financial (NPV/ha)*	33,806	48,964	-50,317	-4,579	-	-
	Economic (NPV/ha)	641,816	584,257	669,562	404,499	-	-
10% increase of labour intensity	*Financial (NPV/ha)*	33,806	48,964	-39,798	4,188	-	-
	Economic (NPV/ha)	641,816	584,257	742,498	449,592	-	-

Overall, the outcomes of the farming model are very sensitive to any variation of cost, yield or price factors. So that testing the assumptions yields immediately a negative NPV.

7.1.4. Carbon storage

Evaluation of carbon storage value is based on a hypothesis of gradual reduction of the remaining forest (1010 ha) primarily caused by shifting cultivation and especially creation of farms (banana-cocoyam-based) within the forest. The estimates of the carbon released following slash and burn is based on Kotto *et al* (2000) and summarized in the table 30.

Table 30: Carbon sequestration by land uses

Land use	***tC/ha***
Selectively logged forest ~ secondary forest	228
Crop/long fallow ~ sustainable agriculture	76
Crop/chromolaena fallow ~ slash and burn agriculture	12

The main assumption of the model is that the forest is converted into crop farm by the means of slash and burn causing a direct release of CO2 to the atmosphere. The land uses concerned are secondary forest on the one hand and slash and burn agriculture on the other hand, hence the net carbon emitted is 228-12= 216 tC/ha.

The deforestation rate is based on the farming expansion hypotheses set up earlier for the farming model. Table 31 gives a summary of the cost incurred as a consequence of deforestation.

Table 31: Returns per ha of avoided deforestation in the COPAL CF

Scenario	***Economic NPV @5% CFAF/ha***
Scenario 1	-153,965
Scenario 2	-315,707
Scenario 3	-184,759

The management regime following the strict term of the SMP induces the lower costs to the society. However, it is worth mentioning that the overarching cause of deforestation is related to activities intended for development. It is therefore suggested that valuation of 'costs of avoiding deforestation' be based on the opportunity cost of the next best alternative namely, agriculture. Thus, only a price increase of the ton carbon at 7500 CFAF/tCO_2 (US$ 15/tCO_2) can help to compensate the opportunity cost associated with the necessity to keep the forest untouched for carbon sequestration.

7.1.5. Synthesis of CBA results and overall sensitivity analysis

Summary of financial and economic analysis

Determination of the project worth will require to consider all of the activities under analysis and to sum up their returns per ha in order to determine which among the different scenarios

is the best. The table 32 summarizes the results of the financial analysis for each of the different scenarios under study.

Table 32: Financial and Economic NPV per ha for the different scenarios at 5% discount rate in COPAL CF

Forest uses	***Scenario 1: Strict implementation of the SMP*** **(CFAF/ha)**		***Scenario 2: No community forest*** **(CFAF/ha)**		***Scenario 3: Adjusted implementation of the SMP*** **(CFAF/ha)**	
	Financial	*Economic*	*Financial*	*Economic*	*Financial*	*Economic*
Timber exploitation	11,987	17,490	18,703	25,123	7,242	12,055
NTFP collection	41,610	48,605	30,246	38,009	38,516	82,792
Food crop farming	33,806	641,816	48,964	584,257	31,009	608,668
Carbon storage	-	-153,965	-	-315,707	-	-184,759
Total	***87,403***	***553,946***	***97,913***	***331,683***	***76,767***	***518,756***

From the above table it appears that the strict implementation of the SMP is the best scenario from the economic efficiency point of view, and the best alternative as long as implementation of the SMP is concerned. The financial advantage of the "business-as-usual" scenario is mainly contributed by timber exploitation that is performed informally (i.e. without the need to fulfill any of the requirements pertaining to the running of the CF such as the annual forest inventory). The financial comparative advantage of the scenario 1 over the scenario 3 is essentially conferred by the value of NTFPs, which with a relative price change generates high returns to the community. Moreover, it can also be argued that in the case the local population decides to adopt sustainable harvesting of NTFPs (i.e. according to the scenario 1), they will still feel a positive net welfare in comparison of the two scenarios, with the advantage of securing resource for the next cycles.

Overall sensitivity analysis

The results are tested for their sensitivity to changes in the discount rate, using several different rates (3%, 8%, 12%, 35%).

The base case is here considered as the strict implementation of the SMP at a discount rate of 5%. The table 33 shows the main results obtained.

Table 33 : Effect of different rates on the net returns per ha (CFAF/ha) in COPAL CF

	Base case (5%)		*3%*	*8%*	*12%*	*35%*
	Strict SMP	*No CF*				
Financial NPV/ha	87,403	97,913	91,144	80,417	70,857	36,166
Economic NPV/ha	553,946	331,683	704,361	399,835	273,629	64,956

In applying various discount rates, the 'strict implementation of the SMP' displays the best returns per ha up to an 8% discount rate in term of economic efficiency. This finding highlights the net welfare that can accrue to the community as a whole through the implementation of the SMP.

7.2. CBA results of BB CF

7.2.1. Timber exploitation

Stream of returns over the project life

The figure 8 shows the net cash flows obtained from timber exploitation for the different scenarios. The cash flows displayed by the scenario 2 ('business-as-usual') are relatively high compared to the other alternatives, mostly within the first years of the cycle. This is mainly due to (1) the great focus placed on hardwood up to the entire depletion of the available stock and, (2) the few requirements timber operators have to fulfill under this management regime (e.g. non-payment of permit fees). However, the hidden reality of this management regime is the drastic reduction of the timber stock, since it does not follow any sustainable principle. In contrast, timber exploitation following the strict terms of the SMP (scenario 1) is likely to provide gradually increasing cash flow over the time, since exploitation is done with respect to the MDE of commercial trees.

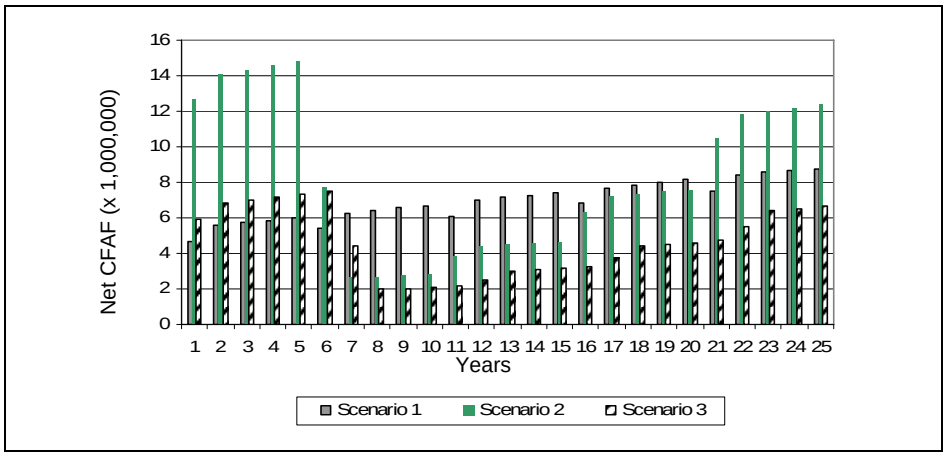


Figure 8: Timber exploitation cash flows for the different scenarios in the BB CF

Results

The table 34 summarizes the return per ha obtained for the different scenarios abovementioned.

Table 34: Timber exploitation net returns per ha for different scenarios in BB CF

Scenario	***Financial NPV @5% CFAF/ha***	***Economic NPV @5% CFAF/ha***
Scenario 1	37,204	48,393
Scenario 2	32,011	42,591
Scenario 3	26,944	37,632

All the scenarios display a positive NPV both from the financial or economic perspective. The scenario 1 of the 'strict implementation of the SMP' provides the best returns per ha over the life of the project, suggesting that both BBNRMC and the local exploiters can be better off in applying such a management regime, mostly if the activity is expected to be carried out for a long term. Hence, it is necessary for the legal entity to update the existing inventory data, and to set up new exploitation quotas accordingly.

Sensitivity analysis

The following assumptions have been used for the sensitivity analysis of timber exploitation in the BB CF:

- Operating costs of the small-scale timber enterprise are higher than expected by 10% (e.g. increase of the permit costs, or lubricant);
- Returns are lower than expected by 10% (e.g. collapse of certain timber prices);

- Annual harvestable timber is lower than expected by 10% (e.g. forest inventory data are not accurate by a certain percentage).

Various discount rates have also been applied. Again, all those assumptions are tested in applying different values of the discount rate to the base case at 5%. The results are presented in the table 35.

Table 35: Sensitivity analysis of timber exploitation in BB CF under alternative assumptions

Assumptions	***Unit (CFAF/ha)***	*Base case (5%) Strict SMP*	*NO CF*	*3%*	*8%*	*12%*	*35%*
10% decrease of returns	*Financial (NPV/ha)*	37,204	32,011	36,010	20,786	14,653	4,688
	Economic (NPV/ha)	48,393	42,591	50,984	28,118	18,853	3,895
10% decrease of annual timber yield	*Financial (NPV/ha)*	37,204	32,011	42,296	24,633	17,478	5,722
	Economic (NPV/ha)	48,393	42,591	55,241	30,718	20,761	4,595
10% increase of costs	*Financial (NPV/ha)*	37,204	32,011	53,189	31,188	22,234	7,392
	Economic (NPV/ha)	48,393	42,591	66,665	37,787	26,015	6,679

Even if the annual returns or the annual harvestable timber decrease by 10%, with a discount rate of 3%, the NPVs of the base case (scenario 1) are still higher than that of the scenario 2. Remarkably, if the costs are to increase by 10%, the scenario 1 still displays the best NPV (31,000 CFAF/ha) compared to the scenario 3 (26,900 CFAF/ha) up to a 8% discount rate.

7.2.2. Charcoal and firewood exploitation

Stream of returns over the project life

The stream of net cash flows over the life of the project for charcoal production is presented in the figure 9. Each of the scenarios displays a steady annual cash flow over the 25 year cycle; with the 'without CF' scenario presenting the highest returns. The cash flows are the direct expression of the type of management applied. While in the scenario 2, the number of trees harvested annually is doubled (88 trees); in the scenario 1 and 3 (strict and adjusted implementation of the SMP) the quantity is reduced at 44 and 31 trees respectively. The scenario 1 is logically the one with the highest likelihood to enable the continuation of this activity for the next cycles, while preserving some tree species such as Ironwood.

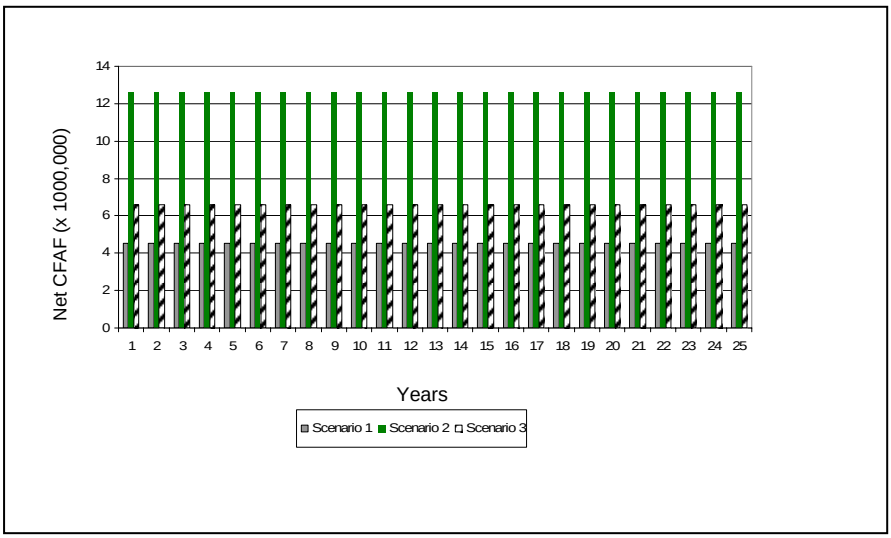


Figure 9: Charcoal production net cash flow for the different scenarios in the BB CF

The net cash flows from firewood production are more illustrative of the correlation between higher harvesting rates upon certain categories of timber and the evolution of returns (cf. figure 10). Indeed, the scenario 2 displays steadily decreasing cash flows reflecting the reduction in quantity of ironwood timber (the highly priced firewood species). Whereas, in the scenario 1, extraction of ironwood is strictly forbidden as a conservation step of the species within the forest, and is reflected through the relatively low returns generated.

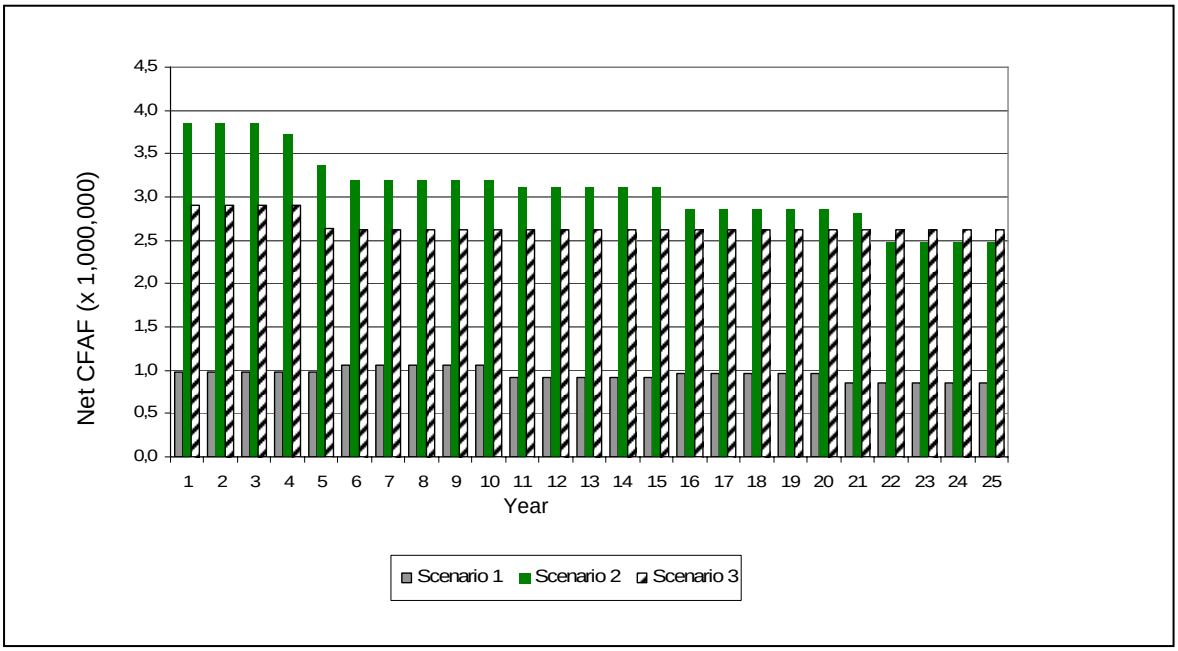


Figure 10: Firewood collection net cash flow for the different scenarios in the BB CF

Results

The results of the financial and economic analysis of charcoal and firewood production are presented in the table36.

Table 36: Net returns per ha for charcoal burning and firewood collection over a 25 year cycle in BB CF

Scenario	***Financial NPV @5% CFAF/ha***	***Economic NPV @5% CFAF/ha***
Charcoal burning		
Scenario 1	25,479	35,764
Scenario 2	47,578	59,196
Scenario 3	37,129	56,778
Firewood collection		
Scenario 1	5,464	10,408
Scenario 2	12,143	19,728
Scenario 3	15,126	22,477

Both charcoal production and firewood collection show a positive NPV for all the alternatives. However, the strict implementation of the SMP is not advantageous compared to the other options. This is explained by the fact that implementation of sustainable harvesting by the legal entity will lead to a decrease of the prevailing rates of extraction. Mechanisms to compensate the benefits foregone by the BBNRMC and the costs borne by the local operators should therefore be developed.

Sensitivity analysis

The following assumptions are set up for both activities:

- The returns are lower than expected by 10%;
- The stems available are lower than expected by 10%;
- The labour intensity is higher than expected by 10%.

The following tables (37 and 38) present the sensitivity analysis results for charcoal and firewood production.

Table 37 : Sensitivity analysis of charcoal production in BB CF

Assumptions	***Unit (CFAF/ha)***	*Base case (5%)*		3%	8%	12%	35%
		SMP	*NO CF*				
10% decrease of the returns	*Financial (NPV/ha)*	25,479	47,578	23,079	14,148	10,395	3,785
	Economic (NPV/ha)	35,764	59,196	35,786	21,938	16,118	5,868
10% decrease of annual stem yield	*Financial (NPV/ha)*	25,479	47,578	28,331	17,368	12,761	4,646
	Economic (NPV/ha)	35,764	59,196	39,768	24,379	17,912	6,522
10% increase of costs	*Financial (NPV/ha)*	25,479	47,578	26,227	16,078	11,813	4,301
	Economic (NPV/ha)	35,764	59,196	40,205	24,647	18,109	6,593

Table 38: Sensitivity analysis of firewood production in BB CF

Assumptions	***Unit (CFAF/ha)***	*Base case (5%)*		*3%*	*8%*	*12%*	*35%*
		SMP	*NO CF*				
10% decrease of the returns	*Financial (NPV/ha)*	5,464	12,143	2,394	1,518	1,135	421
	Economic (NPV/ha)	10,408	19,728	8,503	5,263	3,887	1,423
10% decrease of annual stem yield	*Financial (NPV/ha)*	5,464	12,143	10,353	6,404	4,727	1,729
	Economic (NPV/ha)	10,408	19,728	15,851	9,774	7,203	2,631
10% increase of costs	*Financial (NPV/ha)*	5,464	12,143	3,065	1,935	1,444	534
	Economic (NPV/ha)	10,408	19,728	9,784	6,055	4,471	1,636

The results of the sensitivity analysis confirm that, for both activities, the scenario 1 is not the best alternative. Even at a 3% discount rate, the scenario 2 and 3 display NPVs higher than the scenario 1. This result is consistent to the measure of conservation earlier mentioned, that consist for the legal entity to protect ironwood trees, and as a consequence to forgo the profits that would have been derived from other management options.

7.2.3. Farming activities

Stream of returns over the project life

The figure 11 presents the net cash flows for farming activities in the BB CF over the 25 year cycle. The main variable is the farmland size that varies in function of the annual farm expansion rate. This latter has an evident incidence on the cash flows of the scenario 2 (+100 ha/year), that are relatively higher in comparison of the other scenarios. The cash flows of the scenario 1 (+30ha /year) are quite well distributed over the life of the project, and points up the sustainability of income provided through implementation of sustainable agriculture.

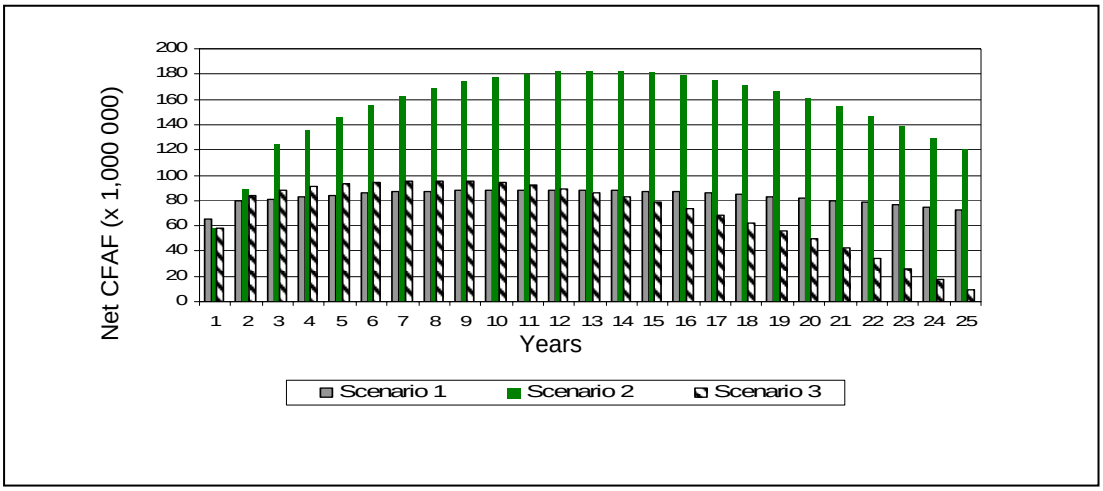


Figure 11: Farming net cash flows for the different scenarios in the BB CF

Results

The net returns per ha generated by each of the management regimes are given in the table40.

Table 39: Net returns per ha for small-scale agriculture over a 25 year cycle in the BB CF

Scenario	***Financial NPV @5% CFAF/ha***	***Economic NPV @5% CFAF/ha***
Scenario	466,554	1,346,311
Scenario 2	562,980	1,499,623
Scenario 3	431,185	1,490,839

Following the presentation of farming cash flows, the situation 'without CF' (scenario2) predictably displays the best net returns per ha (562,980 CFAF/ha) from the financial point of

view. However, the 'strict implementation of the SMP' scenario stands as the best alternative as long as implementation of the SMP is concerned. This may justified the adoption of sustainable agriculture in the BB CF in order to conserve the biodiversity-rich area of the forest.

Sensitivity analysis

The assumptions to be tested against the base case scenario (at 5% discount rate) are as follows:

- Yields are lower than expected by 10%;
- Returns are lower than expected by 10%;
- Labour intensity is higher than expected by 10%.

The results of the sensitivity analysis are presented in the table 40.

Table 40: Sensitivity analysis of farming activity in BB CF

Assumptions	***Unit (CFAF/ha)***	*Base case (5%)*		*3%*	*8%*	*12%*	*35%*
		Strict SMP	*NO CF*				
10% decrease of the returns	*Financial (NPV/ha)*	466,554	562,980	519,160	317,052	231,430	80,308
	Economic (NPV/ha)	1,346,311	1,499,623	1,520,735	897,088	641,141	212,533
10% decrease of annual crop yield	*Financial (NPV/ha)*	466,522	562,980	-822,344	-344,353	-	-
	Economic (NPV/ha)	1,346,311	1,499,623	-400,067	-43,684	-	-
10% increase of labour costs	*Financial (NPV/ha)*	466,522	562,980	416,728	261,739	194,245	69,921
	Economic (NPV/ha)	1,346,311	1,499,623	1,529,537	906,208	649,472	216,838

The net returns per ha of farming activities are very sensitive to the yield factor, so that, when the yield decreases by 10%, even at a 3% discount rate the NPV turns negative. In the same connection, an increase by 10% of the labour cost at a 3% discount rate will yield a net return per ha (~ 417,000 CFAF/ha) inferior to that of the scenario 3 (~ 474,000 CFAF/ha).

7.2.4. Ecotourism

Following Ruitenbeek (1989), a crude estimate of the value of the ecotourism good has been estimated. The average expenditure for a visitor coming in BB CF is about 30,000 CFAF/day distributed in cost of car renting, food, lodging, token to traditional chief in Dikolo village, and an average entrance fee of about 7,500 CFAF paid to the legal entity. It is expected that with the existence of a best road infrastructure and a better advertising of the BB CF tour, the number of visitors increase. Hence, it is assumed an increase of 10 visitors per year over the life of the project. The annualized benefits discounted at 5% is estimated at 16,670 CFAF/ha for the whole area, while the net returns of ecotourism to the legal entity is about 3,969 CFAF/ha.

7.2.5. Fishing-ground protection

It is assumed that without mangrove there will be a decrease in the productivity of onshore and offshore fishery. The method developed in this section is based on Ruitenbeek (1989). Unfortunately, a full costs appraisal has not been undertaken, neither in the study of Bennet and Reynolds (1993) who valued the effect of forest mangrove conservation on fisheries. The main objective of their studies – with respect to time and data constraints - was to highlight (in a conservative way) the gross value associated to watershed protection and particularly mangrove conservation.

The indirect effect of protecting the mangrove of the BB CF may greatly benefit to the fishing port of Mabeta, which is in the direct extension of the CF. Mabeta is one of the largest fishing ports of the study site, essentially oriented on the fishing of crayfishes. The number of boats operating in this port is presently estimated at 280 (pers. comm. Sahmo Saa), considering the transport capacity of a boat between 3-5 people, the number of persons directly dependent upon this activity is about 840. This figure shows a relative increase of the number of fishers in this area, which were about 620, ten years ago (Njifonjou, 1996). This is consistent with the expected trend in the evolution of the activity in the region as more and more foreigners join it.

Using the average per capita incomes for fishers, which is about 121,844 CFAF in Cameroon (Mohammadou *et al*, 2006), the gross fishery value is estimated at 102, 35 millions CFAF *per annum* for the region. This estimate actually concerns the total forest mangrove area of about 1620ha (ERM, 1998). The mangrove forest of the BB CF represents nearly 10% of the total mangrove area, mostly located in the Dikolo peninsular. Thus, the value of fishery resulting

from the protection of mangrove is about 10,235,000 CFAF ($ 20,470), yielding a *per* ha value of about 50,000 CFAF ($100). This relatively high *per* ha value (~$100) compared to that of Ruitenbeek (~ $14/ha) can be correlated to the small area of forest mangrove (200ha) supporting fishery production. However, if this benefit is to be expanded to the entire conserved forested land, the calculated per ha value (~ $25/ha) is relatively close to the one abovementioned. This benefit is to be directly associated to the strict implementation of the SMP made possible by a better performance of the monitoring team.

Under a less rigorous management, it is expected that the existing mangrove forest undergoes a gradual reduction consequently to the many of extractive activities that commonly take place in such areas. Thereby, it is assumed a gradual drop of 15% and 2% per year respectively for the scenario 2 and the scenario 3.

The following table summarizes the returns per ha generated by this service.

Table 41: Net returns per ha for the fishing-ground protection over a 25 year cycle in BB CF

Scenario	***Economic NPV @5% CFAF/ha***
Scenario 1	563,758
Scenario 2	198,984
Scenario 3	479,121

This crude estimate of the gross value of fishery gives an idea of the costs that can be incurred to the society as a result of the destruction of the mangrove.

7.2.6. Carbon storage

The methodology used here is similar to that of the COPAL CF. The slight difference is that a portion of the forest (core zone and mangrove) is protected for conservation purpose, and therefore represents a typical carbon sink. It is assumed that the forest area decreases gradually with the creation of new farms in the core zone.

This value occurs as a one-time benefit in the analysis. The degradation of the forest that occurs in the other scenarios corresponds to a decrease of this value. The table 42 gives the net returns per ha for carbon sequestration in the different scenario.

Table 42: Carbon sequestration NPVs for the different scenarios in the BB CF

Scenario	***Economic NPV @5% CFAF/ha***
Scenario 1	324,000
Scenario 2	190,560
Scenario 3	303,660

7.2.7. Management costs

Since the main goal of the BB CF is conservation through establishing of a protected area and the sustainable use of forest resource in the rest of the CF, there is a need to commit staff to monitor the effective implementation and respect of the provisions of the SMP, by each of the groups using the forest. To ensure that human impacts within the core zone are being minimized and to discourage illegal harvesting of resources within the forest, regular patrols are undertaken by a specialized structure of the BBNRMC known as the operation committee (OC). The members of the OC are mainly volunteers, and thereby are not actually paid as full workers; rather they receive an incentive of 10,000 CFAF ($20) on a monthly basis. The sum collected in term of fines and sales of confiscated products represent a considerable portion of the revenues accruing to the CF. In 2006, about 1,840,000 CFAF ($3680) were collected representing 45% of the revenues from local exploitation of forest products. These figures point up the high pressure that is currently exerted on the CF by various user groups. It can be argued that if this forest was still under the control of the forest administration service-characterized by the lack of material and logistical capacity - a great deal of it would have been depleted today.

Members of the OC do not always show an exemplary behaviour. In some occasions, OC members turned blind eyes to some malpractices during field inspections for a tip from the defaulters. Low wages have always been evoked as the driver of such an attitude.

It is therefore very likely that, measures such as an increase of the wages paid to the patrollers, accompanied with the granting of full worker rights help curb this situation and have a positive effect on the effectiveness of their work. Further on this point is taken into account in the model by assuming a slight increase of the current wages, as effective

monitoring appears to be one of the necessary conditions regarding the threat that weighs on the existence of the BB CF.

Funding committed for patrolling activities usually involved renting of a vehicle, communication fees, and incentives to the patrolling crew in case of a fruitful inspection, and the monthly incentives paid to the members of crew.

Ten patrols are carried out in average each month of the year, giving 120 patrols per year. Over the 120 patrols, in average 30% of inspections end successfully with seizures of chainsaws, timber boards or fuelwood logs. An improvement on the salary of patrollers can positively translate either by an increase in the number of permits delivered or through an increase of the number of seizures.

The other costs are related to the review process of the SMP as seen before (cf. section 6.3.)
The figure 12 shows the net cash flows for the scenario 1 and 3. It appears that the annual cash flows of the scenario 1 over the 25 – year cycle, are rather largely negative compared to that of the scenario 3. This is mainly attributable to the wage increase of patrol members, so that to increase the efficiency of the work.

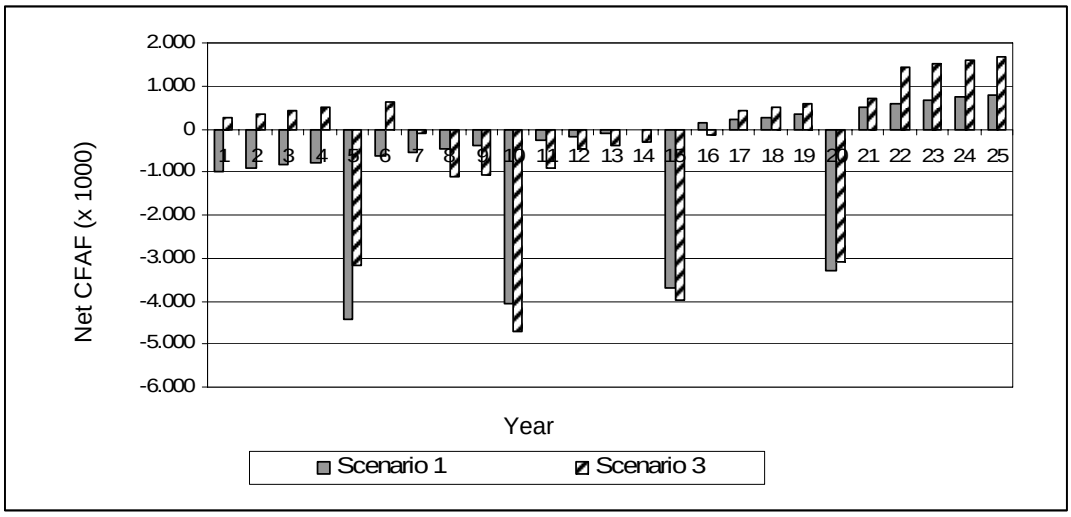


Figure 12 : Management cost cash flows for the scenarios 1 and 3 over the 25-year cycle in the BB CF

The management costs incurred by the BBNRMC are presented in the table 43. The resulting net cash flow is calculated by subtracting the direct costs incurred by the legal entity to running the project with the revenues generated through the granting of various permits.

Table 43 : Net returns per ha for managing the BB CF

Scenario	***Financial NPV @5% CFAF*/ha***	***Economic NPV @5% CFAF/ha***
Scenario 1	-3,325	-3,325
Scenario 2	-	-
Scenario 3	-1,748	-1,748

The discounted cash flow of the legal entity displays a negative NPV. That is to say the project of implementing the CF is worse off. However, regarding the conservation goal associated to the BB CF and the derivable benefits than can accrue to various stakeholders, these figures simply highlight the necessity to support the structure in charge of the management of the CF through grants.

7.2.8. Synthesis of the CBA results and overall sensitivity analysis

<u>Summary of financial and economic analysis</u>

The results of the overall net returns for the different alternatives are summarized in the table 44.

Table 44: Financial and economic NPV per ha for the different scenarios at 5% discount rate in BB CF

	Scenario 1: Strict implementation of the SMP **(CFAF/ha)**		***Scenario 2: No community forest*** **(CFAF/ha)**		***Scenario 3: Adjusted implementation of the SMP*** **(CFAF/ha)**	
	Financial	*Economic*	*Financial*	*Economic*	*Financial*	*Economic*
Timber exploitation	37,204	48,393	32,011	42,591	26,944	37,632
Charcoal burning	25,479	35,764	47,578	59,196	37,129	56,778
Firewood collection	5,464	10,408	12,143	19,728	15,126	22,477
Farming	466,554	1,346,311	562,980	1,499,623	431,185	1,490,839
Ecotourism	16,669	16,669	-	-	16,669	16,669
Carbon storage	-	324,000	-	190,560	-	303,660
Fishing-ground protection (200ha)		563,758	-	198,984		479,121
Management costs	-3,325	-3,325	-	-	-1,748	-1,748
Total	***548,045***	***2,341,978***	***654,712***	***2,010,682***	***525,305***	***2,405,429***

The scenario 1 of strict implementation of the SMP though displaying a net positive NPV (548,000 CFAF/ha) is nevertheless lesser attractive in term of financial efficiency compared to the scenario 2. However, the incorporation of the environmental services such as fishing-

ground protection or carbon storage raises its worth. The net welfare that the society accrues as a result of the strict implementation of the SMP (2,340,000 CFAF/ha) is quite similar to that of scenario 3. Interestingly, both CF alternatives are economically worthier compared to the 'without CF' scenario. This result pinpoints the 'must' to support a community forest where conservation objectives are concerned.

Overall sensitivity analysis

As with the case of COPAL CF, a range of different discount rates are used to test the base case (scenario 1 at 5% discount rate). The results of the sensitivity analysis are reported in the table 45.

Table 45: Effect of discount rate on the net returns per ha (CFAF/ha)

	Base case (5%)		*3%*	*8%*	*12%*	*35%*
	Strict SMP	*No CF*				
Financial NPV/ha	548,045	654,712	680,702	411,813	299,081	102,765
Economic NPV/ha	2,341,978	2,010,682	2,847,826	1,826,140	1,404,710	690,198

Though financial NPVs of the base case (scenario 1) are lesser compared to that of the scenario 2 (for discount rate > 5%), it is however interesting to note that at a 3% discount rate, the scenario 1 displays the highest net returns per ha (~ 681,000 CFAF/ha). From the economic side, it appears that with a discount rate of 8% the net returns per ha from 'the strict implementation of the SMP' (~1,800,000 CFAF/ha) is lesser than that of the scenario 2 (~2,000,000 CFAF/ha).

With the application of a low discount rate (e.g. 3%), the scenario 1 displays the best NPVs. These findings are consistent with the nature of the activities implemented in the CF and the commitment of the legal entity to conserving the forest.

7.3. Distribution of costs and benefits among stakeholders

The implementation of the CF, through undertaking of a number of activities will lead to cost and benefits to different actors. These latter, might be identified at the local, nationwide as well as global level.

7.3.1. In the COPAL CF

In the COPAL CF, where the local population is quite involved in the process, the cost of adopting a new management regime will certainly be borne by the whole community. Same for the benefits, that will accrue to the local community.

The main stakeholders identified as related to the uses of the forest in the COPAL CF are: the community members; the legal entity; individuals in the villages (local operators) and the global community (world). The returns per ha have been apportioned for these different category of actors and are presented in the table 46.

Table 46: Allocation of net returns per ha for different actors in the COPAL CF

	COPAL	***Community***	***Local operators***	***Global***
Forest uses	***Scenario 1: 'Strict implementation of the SMP'***			
Timber exploitation	11,987	9,942	-	
NTFP collection	4,161	37,449	-	
Farming		33,806	-	
Carbon storage			-	-153,965
Total:	***16,148***	***81,197***	***-***	***-153,965***
	Scenario 2: 'No Community Forest'			
Timber exploitation	-	9,530	18,703	
NTFP collection	-	30,246		
Farming		48,964		
Carbon storage				-315.707
Total:		***88,740***	***18,703***	***-315,707***
	Scenario 3 : 'Adjusted implementation of the SMP'			
Timber exploitation	7,242	9,034	-	-
NTFP collection	3,852	34,664	-	-
Farming	-	31,009	-	-
Carbon storage	-	-	-	-184,759
Total:	***11,094***	***74,977***		***-184,759***

The scenario of 'strict implementation of the SMP' is likely to provide the COPAL cooperative, with the best net returns per ha (~ 16,000 CFAF/ha). In this case, the legal entity is the structure expected to run the small-scale timber enterprise. Similarly, with the system of

functioning of existing cooperatives and common initiative group in the study area, the COPAL will deduct a percentage (say 10%) from the group selling of different NTFPs of interest. It is worth to note that, the society as a whole also benefits from the management regime under scenario 1. Indeed, compared to the other alternatives, the scenario1 is the one to cause little damage costs as a consequence of CO_2 release (for instance the net incremental benefit between scenario 1 to 2 is 162, 000 CFAF/ha). It would therefore be necessary to compensate the local community engaged in the sustainable use of the forest, so that to maintain the continuous provision of this service to the world.

7.3.2. In the BB CF

The case of the BB CF concerning the issue of allocation of costs and benefits among stakeholders appears to be more interesting with regards to the complexity of the area.

The net returns of the CF implementation will be shared among some group of stakeholders namely, the legal entity BBNRMC, the various user groups of the resource (charcoal burner, timber exploiter, firewood collectors, etc.), the Cameroonian nation, and the world (global benefits).

The allocation by recipient groups of costs and benefits of different management regimes is furnished in the table 47.

Table 47: Allocation of net returns per ha for different actors in BB CF

	BBNRMC	***User group***	***Nation Cameroon***	***Global***
Forest uses	***Scenario 1 : 'Strict implementation of the SMP'***			
Timber exploitation	-	37,204		
Charcoal burning	-	25,479		
Firewood	-	5,464		
Farming	0	466,554		
Ecotourism	-	-	12,701	
Carbon storage	-	-		324,000
Fishing-ground protection	-	-	563,758	
Management costs	-3,325	-	-	-
Total:	***-3,325***	***534,701***	***576,459***	***324,000***
	Scenario 2: 'No Community Forest'			
Timber exploitation	-	32,011		
Charcoal burning	-	47,578		
Firewood	-	12,143		
Farming	-	562,980		
Ecotourism	-	-		
Carbon storage	-			190,560
Fishing-ground protection	-		198,984	
Management costs	0			
Total:	***0***	***654,712***	***198,984***	***190,560***
	Scenario 3: 'Adjusted implementation of the SMP'			
Timber exploitation		26,944		
Charcoal burning		37,129		
Fuelwood		15,126		
Farming		431,185		
Ecotourism			12,701	
Carbon storage				303,660
Fishing-ground protection			479,121	
Management costs	-1,748			
Total:	***-1,748***	***510,384***	***491,822***	***303,660***

Looking at the distribution of the net returns per stakeholders, it is interesting to see that a good share of the net benefits is allocated nationwide. While a non-negligible part is brought as benefits to the world (~ 324,000 CFAF/ha). The loser appears to be the legal entity in charge to ensure the sustainable management of the forest. The acknowledged deficit of the BBNRMC should be compensated by the gainers. For instance, mechanisms should be developed to offset the local population mostly if they have to forgone the benefits associated to a certain land use (such as slash-and-burn agriculture in favour of carbon storage).

8. Summary and recommendations

This study evaluated that community forest projects in COPAL CF and BB CF can be with some respects a recommendable venture as compared to a situation 'without CF'. Implementation of the SMP according to its strict terms – that is mainly, harvesting of forest resources according to (sustainable) constant extraction rate over the time of the project - is evaluated with view to determine its financial and economic efficiency as compared to some management alternatives. These alternatives include the 'without CF' scenario or 'business-as-usual' scenario (scenario 2) which entails an exploitation under an 'open access' regime and, the 'adjusted implementation of the SMP' (scenario 3).

In the COPAL CF, the 'strict implementation of the SMP alternative' displays a positive net return per ha both financially (~87,000 CFAF/ha) and economically (~554,000 CFAF/ha). This scenario compared to the other alternatives, has the best NPV in economic terms. While, from the financial efficiency side, the 'without CF' scenario displays the best net returns per ha (~98,000 CFAF/ha). However, where implementation of the SMP is concerned, the 'strict implementation of the SMP' scenario yields higher returns per ha than in the scenario 3. Among the extractive activities the collection of NTFPs provides the highest NPV (42,000 FCFA/ha). This suggests that with a relative modest rise of the selling price over the farm gate price, sustainable harvesting of NTFPs as required by the SMP can be undertaken without making the business unprofitable. Overall, both SMP-based alternatives exceed the situation of the scenario 2 from the perspective of the society. This net advantage is provided by the value of the carbon stored, across the different management regimes as a result of the implementation of less destructive agricultural practices.

Likewise, in BB CF the results provided by the CBA framework are quite similar to that of the COPAL CF. The 'strict implementation of the SMP' scenario shows a positive NPV (~548,000 CFAF/ha). But is however inferior to that of the scenario 2 (~655,000 CFAF/ha). On the opposite, the economic analysis presents the 'adjusted implementation of the SMP' scenario as the best alternative (2,400,000 CFAF/ha) before the scenario 1 (2,342,000 CFAF/ha). This net welfare is to be related to the many environmental services offered by the forest that contributes to about 40% of the total value of net returns per ha. The management of the CF by the legal entity displays a negative NPV (~ -3,000 CFAF/ha) indicating that its investment in this project is not worth. Paralleling this finding with the allocation of net returns per group affected by the project, it is interesting to observe that on-going conservation generates benefits both nationwide (~576,400 CFAF/ha) with the protection of fishery production and ecotourism; and to the world (~324,000 CFAF/ha) through avoidance of deforestation.

Sensitivity analyses are also made in this study to observe variation in the net returns per hectare by using a range of different discount rates namely, +3%, +8%, +12%,+35%, along with different assumptions about costs, yields and returns, that are tested against the results of the base case scenario (at 5% discount rate). The sensitivity analysis results obtained in the COPAL CF confirm the economic efficiency of the 'strict implementation of the SMP' scenario. Indeed, this management option yields the best returns per ha (~ 400,000 CFAF/ha) up to an 8% discount rate. Whereas, in the BB CF, the NPVs are rather quite sensitive to any change of the discount rate. Thus, the 'strict implementation of the SMP' option presents the highest returns per ha for a low discount rate of 3%. These results are consistent with many studies that find that environmentally-friendly land use options are superior in economic terms, only when indirect use and non-use forest values are included in the CBA (IIED, 2003).

The following recommendations are given based on the results of this study and observations:

- *Capacity building of local communities (legal entity).* The study highlights the appropriateness that may result in providing the local community with basic analytical tools for the decision-taking process. The "Community Options Assessment and Investment Tool" (COAIT) promoted by the Innovative Resources Management (an American NGO) is one

approach that seems suitable in this sense. It entails the identification, analysis and selection of the best option of development and conservation by the local community (Lescuyer, 2002). What is important is to place the major stakeholders (here the local population) at the heart of the process. This seems particularly relevant for the community forestry, where the forest communities have to take a set of decisions likely to benefit the whole community, while fostering sustainable management of resources.

- *Developing of NTFP management resource plan.* Products other than timber may be of high importance in some CFs. This is particularly relevant for the case of CFs with a poor stock of timber. The COPAL study case, shows that collection of NTFPs may be a worth alternative, provided an appropriate marketing strategy is developed by the legal entity.

- *The need of external financial support.* The study revealed that for CF having a stake in conservation, the financial support of donors or any other partners of development is of practical importance. A large part of forest economic benefits (e.g. carbon sequestration) accrues to stakeholders out of the community. As the benefits enjoyed by the gainers derive from the adoption of sustainable practices by the local community (often implying that community forgoes benefits from other management alternative or land use option), it appears reasonable that they receive an incentive or compensation. For instance, taking the case of management activities in the BB CF, without aid, it is not possible that the legal entity effectively performs activities aiming at conservation.

- *Development of effective transfer mechanisms.* The financial support abovementioned may be realized unless if effective transfer mechanisms are developed towards local population. Therefore proactive capacity-building are needed to increase project uptake in Cameroon (Minang *et al*, 2007).

- *Broaden the research to other CFs.* The research has overall focused attention on poorly endowed CFs, where timber exploitation may not yield as high profits as expected. It will be interesting to extend the research to some timber-rich CFs in the country, in order to determine the management potential of such forests and their likely contribution to local development objectives.

References

Ambrose-Oji B., J.Acworth, G. Abonge, G. Oji and H. Manga (1998). *Rapid agricultural Survey – Methodological Note.* MCP Limbe

Bennett, E.L. and C.J. Reynolds, (1993). *The values of Mangrove Area in Sarawak"* in Biodiversity and Conservation 2(4):359-375

Bimbia Bonadikombo simple management plan (2002).

Bray, D., Merino-Pe´rez, L., Barry, D., (2005). The Community Forests of Mexico: Managing for Sustainable Landscapes. (Eds.)University of Texas Press, Austin.

Brent Robert J. (2006). *Applied cost-benefit analysis, second edition*. Edward Elgar. Cheltenham, UK Northampton MA, USA

Brown, D. (1999) Principles and practice of forest co-management: evidence from West-Central Africa. European Union Tropical Forestry Paper 2, ODI, London.

Brown Peach H.C. (2005). *Governance of non-wood forest products and community forests in the humid forest zone of Cameroon.* Dissertation for the Degree of Doctor of Philosophy. Cornell University. 356 pages

Byron, N. (1991). *Cost Benefit Analysis and Community Forestry Projects*. pp 163-180 in; Gilmour D. & Fisher R.Villagers, Forests and Foresters. Sahayogi Press. Kathmandu, Nepal.

Carletto Calogero (1999). C*onstructing samples for characterizing household food security and for monitoring and evaluating food security interventions: theoretical concerns and practical guidelines*. Technical guide # 8 International Food Policy Research Institute. 2033 K Street, N.W. Washington D.C. U.S.A. IFPRI.

Castrén T., (2005). *Ownership and incentives in join forest management: A survey*. Development Policy Review. 23 (1) : 87-104.

Cuny P., A. Akem A., Z. A. Ondoa, (2006). *An Experience of Local and Decentralised Forest Management in Cameroon: The Case of the Kongo Community Forest.* SNV Cameroon, CIAD Cameroon

COPAL simple management plan (2007).

Davies J. and Richards M. (1999). *The use of economics to assess stakeholder incentives in participatory forest management: a review.* Overseas Development Institute London. European Commission Brussels.

Elevitch, C.R.; K.M. Wilkinson; (2000). *Economics of Farm Forestry: Financial Evaluation for Landowners.* Agroforestry Guides for Pacific Islands #7. Permanent Agriculture Resources, Holualoa, Hawaii, USA.

Enyong Kima A.L. (2001). *Socio-economic farm survey in the Bimbia Bonadikombo Area, Fako Division, South West Province* A consultancy report prepared for the Mount Cameroon Project Limbe. 75 pages

ERM (1998). *Environmental Impact Assessment of plantation expansion by Cameroon Development Corporation in forested Lowland of the Mount Cameroon region.* A report prepared for MCP, Limbe and DFID, London mimeo.

Ezzine de Blas; M.N. Pérez ; (2005). *Community forests : shadows and lights in rural Cameroon.* University Autonomous of Madrid. Department of Ecology. 40 pages

Fawoh Julie (2002). *The viable resource management model for participatory biodiversity conservation in the Bimbia Bonadikombo area.* Mount Cameroun Project – Phase II. Regional Center For Development and Conservation (RC DC). Limbe. 39 pages.

Fomete T., J. Veermaat, (2001). *Community forestry and poverty alleviation in Cameroon.* Rural Development Forestry Network. ODI-DFID-FRR N°25h

Gardner, A. A., J. DeMarco and C. A. Asanga (2001), 'A Conservation Partnership: Community Forestry at Kilum-Ijim, Cameroon', Rural Development Forestry Network 25h:9-16.

Gilmour D., Malla Y., Nurse M. ; (2004). *Linkages between community forestry and poverty.* Regional Community Forestry Training Center for Asia and the PacificBangkok, Thailand (RECOFTC)

Gockowski J., Tonye J, Baker D., Legg C., Weise S., Tchienkoua M., Ndoumbé M., Tiki-Manga T.. and Fouaguégué A. (2004). *Characterization and diagnosis of farming systems in the forest margins benchmark of Southern Cameroon* International Institute of Tropical Agriculture. Social Working Paper Series N° 1. 75 pages

Gregersen H.; Contreras A.; (1992). *Economic assessment of forestry project impacts. No° 106.* World Bank, United Nations Environment Programme, Food and Agriculture Organization.

Grieg-Gran M., (2006). *The cost of Avoiding deforestation.* Report prepared for the Stern Review of the Economics of climate change.IIED. 20 pages

Hanley N. and Spash C.L., (1993). *Cost-Benefit analysis and the environment.* MPG Book, Bodmin, Cornwall

Hodgson, G.; J. A. Dixon. (1988). *Logging Versus Fisheries and Tourism in Palawan*. Occasional Paper No.7, East West Environment and Policy Institute: Honolulu.

Howard, P., (1995). *"The Economics of Protected Areas in Uganda: Costs, Benefits, and Policy Issues"*. Unpublished dissertation, University of Edinburgh, summarised in Bagri, A., Blockhus, J., Grey, F. and F. Vorhies (eds.). 1998. *Economic Values of Protected Areas: A Guide for Protected Area Managers*. IUCN: Gland.

IIED, (2003). *Valuing forests. A review of methods and applications in developing countries.* Environmental Economic Programme. 167 pages.

Klein M., Salla B.; Kok J. (2001). *Attempts to established community forests in Lomié, Cameroon.* Network paper 25f. Rural development forestry network.ODI. 13 pages

Koffi Yeboa A., (2005). *Sciage artisanal, transformation et commerce du bois d'oeuvre du Cameroun à destination de l'arc soudano-sahélien.* Mémoire de l'Ecole Nationale du Génie Rural, des Eaux et des Forêts. 81 pages.

Kotto-Same J., Moukam A., Njomgang R., Tiki-Manga T., Tonye J., C. Diaw, J. Gockowski, S. Hauser, S. Weise, D. Nwaga, L. Zapfack, (2000). *Alternatives to Slash-and-Burn. Summary Report and Synthesis of Phase II in Cameroon.* Nairobi, Kenya 76 pages

Kumari K., (1995). *An Environmental and Economic Assessment of Forest Management Options: A Case Study in Malaysia*. Environmental Economics Series No. 26, Environment Department, The World Bank: Washington D.C.

Larson, A. (2004) Democratic decentralisation in the forestry sector: lessons learned from Africa, Asia, and Latin America. Working paper CIFOR, Interlaken workshop.

Limbe Botanic Garden and Rainforest Genetic Conservation Project (1993). *Forest Inventory Report of the Proposed Mabeta-Moliwe Forest Reserve, South West Province, Cameroon.* 18 pages

Lescuyer G., (2007). *Livelihoods and the adaptive application of the law in the forests of Cameroon*. in "Illegal Logging: Law Enforcement, Livelihoods and the Timber Trade", L.Tacconi (Ed.), Earthscan, London, 167-90

Lescuyer G. ; (2002). « *Vers une analyse économique au service des acteurs locaux »*. Rapport de mission. Cameroun 27 mai au 08 juin 2002. Projet COAIT – Innovative Resources Management. 26 pages.

Lescuyer G. ; (2000). *Evaluation économique et gestion viable de la forêt tropicale*
Réflexion sur un mode de coordination des usages d'une forêt de l'Est-Cameroun. Thèse de doctorat de l'Ecole des Hautes Etudes en Sciences Sociales. 416 pages.

Mayers J. (2006). *Small and medium-sized forestry enterprises – Are they the best bet for reducing poverty and sustaining forests?* Tropical Forest Update 16 (2): 10-11

Minang P.; Mc Call M.K.; Bressers H.Th; (2007). *Community Capacity for Implementing Clean Development Mechanisms Projects Within Community Forests in Cameroon.* Environnemental Management 39:615-630. Research. Springer.

MINEF – DFID ; (2004). *Etat des lieux de la foresterie communautaire au Cameroun.* 149 pages

MINEF (1998). Manuel des normes et procédures d'attribution de s forêts communautaires.

Mohammadou H. ; Sahmo Saa J.B. ; Edima N. (2006). *Profil Post-Capture. Cameroun/Peche artisanale.* Programme pour des moyens d'existence durables dans la pêche en Afrique de l'Ouest. FAO, DFID.

Ndoye O. and Kaimowitz D., (2000). *Macro-economics, markets and the humid forests of Cameroon, 1967-1997.* The Journal of Modern African Studies, 38, 2 (2000), pp. 225±253 Cambridge University Press

Njebet C. ; Vabi M. ; (2000). *Rapport du forum d'échanges d'expérience de terrain. Mise en place des forêts communautaires au Cameroun.* MINEF, Nguélémendouka.

Njifonjou O. (1996). *Etude des coûts et revenus en pêche artisanale maritime dans la région de Limbé au Cameroun.* CRHOL Limbé. 23 pages

Nuesiri Emmanuel O; (2007). *Papa's Land: Migrants, Community Forestry and Citizenship*. 4th Cadbury Workshop 'Travel, environment and local knowledge'.Centre for West African Studies (CWAS) – University of Birmingham. Oxfor University Center for the environment.

OECD, (2007). *African Economic Outlook: Cameroon.* AFDB/OECD 2007. Available online at http://*dx.doi.org/10.1787/063478386420*

Omura Makiko, (2004). *Cost-benefit analysis revisited: is it a useful tool for sustainable development?* Kobe University Economic Review 50(2004)

Olschewski Roland (2006). *Economic assessment of forestry projects*. 3rd revised edition, International Forest Economics. Institute of Forest Economics, Faculty of forest Science and Forest Ecology, Georg-August University of Goettingen.

Oyono P.R., Ribot J.C., Assembe S., Bigombé Logo P., (2007). *Correctifs pour la gestion décentralisée des forêts au Cameroun : options et opportunités de 10 ans d'expérience.* Policy brief. Forest and Governance Programme, CIFOR.

Pagiola, S., (2001). *Economic analysis of incentives for soil conservation. In: Incentives in soil conservation: From theory to practice.* Sanders,D.W., Huszar, P.C., Sombatpanit, S. and Enters, T., (Eds.), World Association of Soil and Water Conservation, Oxford and IBM Publishing Co. Pvt. Ltd., New Delhi, India.

Pearce D., Putz F., Vanclay J.K, (2002). *Is sustainable forestry economically possible? Valuing forest functions.* In Pearce D., Pearce C., Palmer C.(2002). Valuing the environment in developing countries: c*ase studies.* Edward Elgar Publishing . Pages 447-499

Peck Tim, (2001). *The International Timber Trade.* WoodHead publishing limited. 325 pages

Prest A. R.; Turvey R. (1965) *Cost-Benefit Analysis: A Survey.* The Economic Journal, Vol. 75, No. 300., pp. 683-735. Cited in Brent R.J. (2006) Applied cost-benefit analysis, second edition. Edward Elgar. Cheltenham, UK Northampton MA,USA.

Rice R.; C. Sugal; I. Bowles, (1998). *Sustainable Forest Management : a Review of the Current Conventional Wisdom.* Washington, DC: Conservation International.

Ruitenbeek, H.J. (1989). *Social Cost-Benefit Analysis of the Korup Project, Cameroon.* Prepared for the World Wide Fund for Nature and the Republic of Cameroon.

Spalding-Fecher R. (2000). *Financial and economic analysis of CDM projects*. Unpublished working documents.

Scherr Sara J., White Andy, Kaimowitz David, (2002). *Making markets work for forest communities.* Policy Brief. Forest Trends and Center for International Forestry Research.

Shoana S.H., Kainer K. A., (2006). *Local perceptions of forest certification for community-based enterprises.* Forest Ecology and Management 235 (2006) 30-43 Elsevier

Shreckenberg K. and M. Hadley, (1991). *Economic and Ecological sustainability of tropical rainforest management.* MAB DIGEST 8 UNESCO 100 pages

Sohngen, B., R.Mendelsohn and R. Sedjo (1998). *The effectiveness of forest carbon sequestration strategies with system-wide adjustments'*. Resources for the Future, Washington DC, mimeo.

Sunderlin William, (2006). *Poverty alleviation through community forestry in Cambodia, Laos, and Vietnam: An assessment of the potential.* Forest Policy and Economics (8) 386-396. Elsevier

Tecsult; Sogreah consultants; (2006). *Projet d'aménagement hydroélectrique de Nachtigal – Cameroun. Etude d'impact environnemental.* Rapport Final. ALUCAM. 770 pages

Tchouto P., Tekwe C., Ngwang R. (1998). *Forest inventory report of the southern Mabeta-Moliwe Forest.* Mount Cameroon Project .Limbe Botanic Garden and Herbarium. 37 pages+appendices

Vabi M.B., Njankoua D., Muluh G.A., (2002). *The costs and benefits of community forests in selected agroecological regions of Cameroon.* CFDP-DFID. 86 pages

Vermeulen C., Vandenhaute M., Dethier M., Ekodeck H., Nguenang G.-M., Delvingt W.; (2006). *De kompia à Djolempoum: sur les sentiers tortueux de l'aménagement et de l'exploitation des forêts commnautaires.* VertigO – la revue en sciences de l'environnement, Vol7 n°1

Yakobo Moyini, (2006). *Economic assessment of Resource Values affected by the 220KV Powerline Wayleave Traversing Mabira, Kifu and Namyoya Central forest Reserves.* Report. Bujagali Hydroelectric Power Project.

Yaron Gil, (2002).*The economic value of Mount Cameroon : alternative land use options. Valuing forest functions.* In Pearce D., Pearce C., Palmer C.. (2002). Valuing the environment in developing countries: c*ase studies.* Edward Elgar Publishing. P.403-446

Waarde J., Tinyu C., Ingram V., (2006). *Biodiversity inclusive impact assessment in Cameroon community forestry* Western Highlands Nature Conservation Network, SNV. 12 pages

White, A., & Martin, A. (2002). *Who owns the world's forests?* Washington, DC: Forest Trends, Center for International Law

Wunder, S. (2001). *Poverty alleviation in tropical forests—What scope for synergies?* World Development, 29(11), 1817–1833.

Websites

Nationale Directorate of Statistics : www.statistics-cameroon.org

Price trend : www.itto.or.jp

Cameroon country profile: www.imf.org

Farm gate value: http://en.wikipedia.org/wiki/farm_gate_value

Gnetum group selling: www.dgroups.org/groups/cgiar/cso-cgiar-forum

Annexes

Annex 1 : Structured questionnaire form

STRUCTURED INTERVIEW TO BE ADMINISTERED TO RANDOMLY SELECTED HOUSEHOLDS WITHIN THE COPAL COMMUNITY

III- Evaluation of non-timber forest products (NTFPs)

This questionnaire purposes to survey a random sample of households within a representative sample of villages within the COPAL CF, in order to access the quantity, value an interest of some NTFPs extracted from the forest. Information collected will be used to strictly academic ends.

Section A : Introduction

A.1.Date of survey
…….

A.2. Name of the village
……

A.3. Household ID ……

A.4. Interviewer ID ……..

A.5. Checked by the supervisor…….

Partie B : Production, consumption, revenues from NTFPs

B.6. Number of people within the household? (To be distinguished between the head of the family, wife, and children)
……

B.7. How many people in the household are involved in NTFPs collection ?
……
B.8. Give three main categories or group of NTFPs you extracted from the forest last year ?
…….....
……
Note : Note the different groups listed below is only to help the enumerator to have an idea on the response of the interviewee and the corresponding NTFPs are to be marked with a cross.

List of non timber forest products present in the forest

N°	Code b	Name	Sub-group NTFP	Code a	Group of NTFPs	Notes
1	001	Poivre	Fruit	00		
2	002	Okok	Leave			
3	003	Bitter Kola	almond			

4	004	Ezezang	Almond		Edible	
5	005	Champignon	Plant			
6	006	Palmier à huile	fruit			
7	007	Andock	Fruits			
8	008	Mbongo	Fruit			
9	009	Ekokom	Fruit			
10	010	Olom	Bark			
11	011	Cola	Fruit	01	Edible and medicinal	4
12	012	Ndong	Fruit			
13	013	Rotin	stem	02	Handicraft	
14	014	Palmier de raphia	Leave, limb			
15	015	Emien	Bark	03	Medicinal	
16	016	Voacanga	Fruit			
17	017	Quinquina	Bark			
18	018	Maranthacées	Leave	04	Wrapping	

B.9. In which area of the forested area do you usually collect those NTFPs (referring to the NTFPs mentioned in question B.8) ?

1. Fallow 2. Savannah 3. Residual forest
4. Farm. 5. Others

B.10 Do you go to the forest sometimes only to harvest some NTFPs?
……
……..
B.11 What is the time devoted to collect a particular NTFP (e.g. Njanssang) ?
……
……
B.12. Are you alone or accompanied during harvesting of those NTFPs ? How many people?
……
……

B.13. Which material do you generally use to harvest those NTFPs ?

……
B.14. How long have you been involved in the collection of NTFPs within the forest?

1). 20 years 2) 15 years
3). 10 years 4) 5 years
5) Other (to write)……

B.15. From your point of view how does the abundance of the collected NTFPs have changed over the last years (Within an interval of five years) ?

1). ☐ constant yield 2). ☐ Decreased yield
3). ☐ Other (to write) ……..……
……

B.16. Estimation of costs and revenues of the main NTFPs collected.

Cost date collection sheet for some NTFPs

Name of the of ntfp **Code b**	**Periodicity of harvesting in one year**	**Abundance of the ntfp** **Code c**	**Cost**						
			Number of people for the harvesting (homme jour)	Time spent for harvesting (number of days per year)	Price of the material (knives, machete, e, pole, etc.) (FCFA)	Processing of the NTFPs		Transport of the good (if sold out of the village)	Additional costs
						Material	Time spent		

Code c : 1. Very abundant 2. Abundant
3. Less abundant 4. Rare

Revenue data collection sheet

Name of the NTFPs **Code b**	**Total Production totale**		**Sale of NTFPs**				**Consumption or harvested quantity used by the household in peasant measurement unit (including gifts made to relatives)**	**Notes**
	How was yied ? 1. Good 2. Average 3. Bad	Quantity in peasant measurement unit ()	Quantity in peasant measurement unit (Write)	Where have been sold the largest part of the NTFPs Code d	Selling practice Code e	Average price of of the NTFP (FCFA)		

Code d: Market location
1. Village market 2. Close to the road
3. To the neighbour 4. To the town 5. Autres

Code e: Selling practices
1. Myself on the market
2. through a middle men
3. mixed 1 and 2
4. Other (write)

STRUCTURED INTERVIEW TO BE ADMINISTERED TO RANDOMLY SELECTED HOUSEHOLDS AROUND BBCF VILLAGES

IV- Evaluation of farming activities

This part of the questionnaire is focused on farming activities. Its objective is to estimate the average size farm for a peasant, the average area occupied by farms within the BBCF, the yield and the quantities produced for the main food crops cultivated, and their value as well.

Section A : Introduction

A.1. Date of survey
…….

A.2. Name of the village
…….

A.3. Household ID ……..

A.4. Address of the household……

A.5. Native or migrants (give place of origin) ……..

A.6. Interviewer ID ……..

A.7. Checked by the supervisor…….

Section B: Information on household

B.1. Main activity of the head of household ……
B.2. Wife occupation ……..
B.3. Number of family members or permanent residents in the household (except from head and wife)
…….
B 4. Category of farmer. 1. Part-time farmer 2. Full-time worker
B.5. Year of experience on farming within the BBCF ……..

Section C. Farming activities

C.0. What kind of farming do you practice?
1. Cash crop cultivation *3. Mixture of cash crop and food crop*
2. Food crop cultivation *4. Commercial food crop*
5. Other (to write)

C.1 What crops do you cultivate each year? (Based on last year)
……
……

C.2 Which type of cropping pattern do you use? What is the current area cultivated for those crop? (fill in the table below according to the respondent's answers)

Owner of the farm *1. Husband* *2. Wife* *3. Other (to write)*	Cropping pattern system *1. mixed cropping 2. mono cropping 3. intercropping*	Crops included in the cropping system	Area cultivated	Age of farm
	Eg.: 1	Eg.: groundnuts/maize/…	0.5 ha	

C3 How many plots do you have for farming activities in your household?

State of the plot *1. active plot* *2. plot in fallow*	Number of plots	Plot area	Cropping sequence Crop 1/crop2/ crop 3/…..

C.4 What is the duration of your fallow? Explain the reasons of the choice?
1. 0-1year *3. 3-4 years*
2. 2-3year *4. 4-5 years* *5. Others (to write)* ……
……
C.5. What is the tenure regime under which you cultivate (land ownership)? If rented what is the rent cost and the time interval on which it is paid? ……
……..
1. Rented land *2. Owned land*
3. Temporary use of the land *4. Other (to write)*

C.5 Where are your farms located?

1. Light green area (give the compartment name).……
2. Black bush (give the compartment name) ……..
3. Other (to write) ……

C 6. How far is your farm from your quarter?

1. Lesser than 500 m *3. At 500 m from the village*
2. Behind the house *4. At 1km*
5. Other (to write) ……

C.7. Before creation of the BBCF where were you opening your farms? Do you find it constraining to perform farming activities under the framework of BBCF (Write reasons)?
……
……
……

C.8. How often do you go to your farm?

1. Once per week *3. Thrice per week*
2. Twice per week *4. Six times per week 5. Other (to write)……..*

C.9. Have you noticed any changes in the yield of the crop cultivated within the few last years compared to some years before (Give reasons)?
……
……

C.10. How do you intend to cope with this situation (where appropriate)?
1 Opening of new farm in the forest *3. Opening of new farms over greater distance*
2. Use of fertilizer *4. Other (to write)……*

C11. What has been the yield for the different crops cultivated last year in term of quantity sold and consumed by the household? (in peasant unit measurement)

Crop	HH consumption	Quantity sold

C.12 Where have you sold it? How much did it cost?

Type of buyer	**Price (CFAF)**
1. Middle man	
2. Member of the family	
3. Sale out of the village to the town	
4. Others	

C.13 What farming tools are used by the household?

Tools	Life of the tool (month, year)	Price (FCFA)
Machete		
Hoe		
File		
Wheelbarrow		
Bucket		
Others (to write)		

C12. Data collection sheet for farming activities

Area of the farm:
Name of crop : Name of the household :

Crop operation	Periodicity within a year (annual or perennial)	Quantity	Labour cost (FCFA)		Additional notes
			Number of people involved (Man-day)	Unit cost	

Annex 2: Major commercial timber species in the COPAL CF

Tree species	Category	Type of wood	DME	Vol exploit total (m3)	Vol expl/ha	Volume total (m3)
Bibolo	1	Hardwood	80	38,727	0,008	141,423
Bete	1	Hardwood	60	146,712	0,031	654,226
Doussie	1	Hardwood	80	658,135	0,137	975,001
Iroko	1	Hardwood	100	91,631	0,019	3432,274
Kotibe	1	Hardwood	80	0	0	23,036
Kossipo	1	Hardwood	80	0	0	35,251
Sapelli	1	Hardwood	100	12,499	0,003	557,089
Sipo	1	Hardwood	80	0	0	4,396
Nkanang	2	Hardwood	50	1386,894	0,289	2564,811
Bilinga	2	Hardwood	80	0	0	21,142
Padouk	2	Hardwood	60	108,458	0,023	245,113
Tali	2	Hardwood	50	1836,409	0,383	2137,473
Azobe	2	Hardwood	60	752,985	0,157	1385,081
Tiama	2	Hardwood	80	24,646	0,005	255,914
Movingui	2	Hardwood	60	115,168	0,024	210,911
Dabema	2	Hardwood	60	229,15	0,048	619,379
Ayous	1	Softwood	80	580,572	0,121	2038,36
Framire	1	Softwood	80	0	0	0,839
Aningre	1	Softwood	60	0	0	7,575
Frake	1	Softwood	60	5387,877	1,122	3550,794
Ilomba	1	Softwood	60	1333,083	0,278	2316,726
Bahia	2	Softwood	60	186,17	0,039	305,761
Bongo	2	Softwood	60	7,967	0,002	58,165
Eyong	2	Softwood	50	16,259	0,003	16,259
Aiele	2	Softwood	60	714,553	0,149	1293,008
Ako	2	Softwood	50	82,069	0,017	132,971
Anguek	2	Softwood	50	48,156	0,01	48,156
Ekop	2	Softwood	60	119,844	0,025	431,598
Emien	2	Softwood	50	1031,085	0,215	1033,697
Fromager	2	Softwood	50	3298,225	0,687	2586,53
Funtumia	2	Softwood	50	0	0	34,761
Okan	2	Softwood	60	259,222	0,054	312

Annex 3: Major timber species in the BB CF

Commercial name (common name)	Type of wood	# of tree/ha today	# of tree expl./ha	Basal area total (m2/ha)	Basal area expl./ha (m2/ha9	Volume expl./ha (m3/ha)
Ebony(ebene)	Hardwood	1,735	0,226	0,173	0,01934	0,116
Dabema (small leaf)	Hardwood	0,620	0,081	0,301	0,03357	0,201
Padouk (camwood)	Hardwood	0,413	0,054	0,262	0,02917	0,175
Bosse	Hardwood	0,207	0,012	0,055	0,00283	0,017
Mahogany(acajou)	Hardwood	0,124	0,007	0,023	0,00119	0,007
Sapele	Hardwood	0,083	0,003	0,003	0,00012	0,001
Doussie	Hardwood	0,124	0,007	0,020	0,00102	0,006
Pachyloba	Hardwood	0,248	0,015	0,130	0,00667	0,040
Bilinga (opepe)	Hardwood	0,124	0,007	0,051	0,00263	0,016
Abam (yellow leaf)	Hardwood	0,041	0,005	0,005	0,00054	0,003
Iroko	Hardwood	0,124	0,005	0,042	0,00144	0,009
Niove(Bobie)	Hardwood	3,223	0,419	0,598	0,06666	0,400
Nkanang	Hardwood	0,661	0,086	0,169	0,01880	0,113
Tiama	Hardwood	0,248	0,015	0,047	0,00240	0,014
Onzabili	Softwood	0,413	0,054	0,184	0,02052	0,123
Emien (milk stick)	Softwood	0,744	0,097	0,384	0,04281	0,257
Ceiba	Softwood	0,207	0,027	0,253	0,02825	0,170
Aiele (bush plum)	Softwood	0,207	0,027	0,139	0,01552	0,093
Frake (Akom)	Softwood	0,785	0,102	0,592	0,06602	0,396
Iatandza	Softwood	0,331	0,043	0,053	0,00596	0,036
Ekop	Softwood	0,165	0,021	0,039	0,00430	0,026
Lati	Softwood	0,248	0,032	0,152	0,01692	0,102
Ebiara(abem)	Softwood	1,281	0,167	0,191	0,02127	0,128
Poga	Softwood	0,041	0,005	0,003	0,00032	0,002
Aningre	Softwood	0,372	0,048	0,108	0,01203	0,072
White Longhi	Softwood	0,455	0,059	0,080	0,00892	0,054
Ekoune (Man carabot)	Softwood	11,941	1,552	2,228	0,24832	1,490
Ilomba (woman carabot)	Softwood	4,876	0,634	1,390	0,15491	0,929
Big leaf	Softwood	0,248	0,032	0,014	0,00156	0,009
Scyphocephalium mannii	Softwood	2,231	0,290	2,352	0,26218	1,573
Enantia	Softwood	0,496	0,064	0,064	0,00709	0,043
			4,198			**6,62**

Annex 4: Evolution of the farm size in the COPAL CF

Year	Household	Population	Farm area/household (ha)	Total (ha)
1	658	5000	1,064	700
2	677	5145	1,064	720
3	697	5294	1,064	741
4	717	5448	1,064	763
5	738	5606	1,064	785
6	759	5768	1,064	808
7	781	5936	1,064	831
8	804	6108	1,064	855
9	827	6285	1,064	880
10	851	6467	1,064	906
11	876	6655	1,064	932
12	901	6848	1,064	959
13	927	7046	1,064	987
14	954	7251	1,064	1015
15	982	7461	1,064	1045
16	1010	7677	1,064	1075
17	1040	7900	1,064	1106
18	1070	8129	1,064	1138
19	1101	8365	1,064	1171
20	1133	8607	1,064	1205
21	1166	8857	1,064	1240
22	1199	9114	1,064	1276
23	1234	9378	1,064	1313
24	1270	9650	1,064	1351
25	1307	9930	1,064	1390

Erklärung

Hiermit versichere ich gemäß § 26 Abs. 6 der Bachelor- und Master- Prüfungsordnung vom 27.08.2002, dass ich die vorliegende Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt habe.

November 2007,

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